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FOR MANAGEMENT IN ELECTRONICS, COMPUTER & SYSTEMS COMPANIES — WORLDWIDE

AUGUST 15, 1988

HIGH TECH IN CHINA

The new private sector

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Wan Runnan
president,
Stone Group

Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER AND SYSTEMS COMPANIES—WORLDWIDE

VOL. 14, NO. 16 AUGUST 15, 1988

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Wan Runnan is the Steve Wozniak of China. Like Wozniak, who cofounded Apple Computer Inc. in a garage in Silicon Valley, Wan, 42, also comes from humble origins. But instead of a garage, Wan and six friends from the Chinese Academy of Sciences founded his computer company, Stone, in a shabby two-room office on a commune in the western suburbs of Beijing. Today, four years later, Stone is the largest independent computer company in China.

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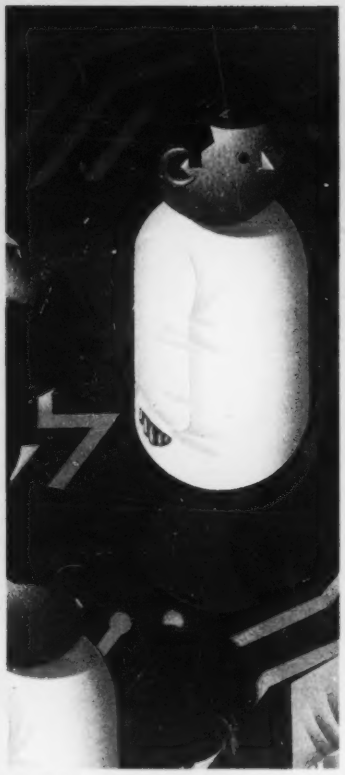

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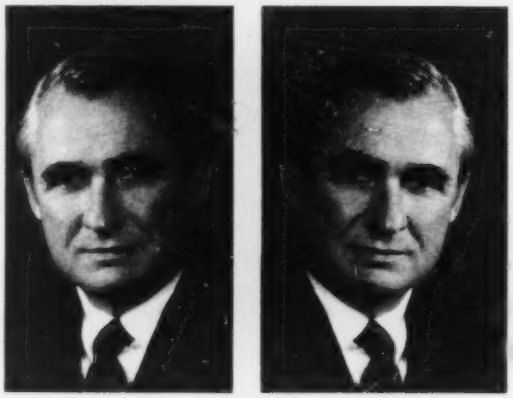
Parting is such sweet sorrow

Some people think that public relations departments play only a marginal role in the success or failure of a company. We disagree. In some cases, a company can live or die — depending on the quality of its in-house public relations.

Nobody know this better than the business press. We depend heavily on PR personnel to provide us with the access we need to the high-powered people who run the international electronics industry. In a sense, they are the gatekeepers to the industry — an awesome job, to say the least.



John Akers: This way . . . not that way

But sometimes, PR departments can take their jobs a little too seriously. Take IBM, for instance. Once again, IBM and its chairman, John Akers, swept into first place in our annual readers' poll of the best companies and best executives in the electronics industry. IBM and Akers took first place in two categories — mainframes and office computers.

To accompany our brief profile of IBM — and the 11 other winners in our poll — we called IBM's headquarters in Armonk, N.Y., and asked the public relations department for a photograph of Mr. Akers. The PR department graciously complied, but warned us not to reverse the negative. (In the publishing trade, when you're on deadline, it's easy to get harried and inadvertently flip-flop a piece of film.)

It seems that a well-known trade magazine, which shall remain nameless, once flip-flopped Akers' photo; and the chairman was not too pleased about it. "Mr. Akers parts his hair on the right," we were told by the PR department in no uncertain terms.

Now, IBM has a lot of friends in the business world. But it also has a lot of enemies. Maybe we're wrong, but one would think that IBM's PR department should be more concerned about improving the corporation's image in the marketplace, and less concerned about the photographic image of its boss.

Stalking the Feds

Speaking of IBM, one article in this issue which we strongly recommend is an analysis by John Dodge — a Boston area business writer — of Big Blue's thrust into the federal computer market.

IBM today owns about half the government personal computer market, but life may be different now that the company has unveiled its Personal System/2 family of PCs. Competition in the federal marketplace is more competitive today than it ever was. If you sell to, compete with or buy from IBM, we think you'll be interested in this article.

Intellectual property rights

Also featured in this issue is the first in a series on the strategic importance of defending your intellectual property rights. The series, which is being coordinated by managing editor John Kerr, offers contributions from several staff members, including Alden Hayashi, Anne Knowles and Valerie Rice.

AL FURST, Editor

Solid growth forecast for solid-state relays

Industrial automation and telecommunications are driving solid-state relay sales, which should top $244 million by 1991

The revitalization of American manufacturing may be having a trickle-down effect on the solid-state relay industry.

The U.S. market for solid-state relays — devices used to control motors, lamps and transformers, among other things — should nearly double in five years, predicts research firm Venture Development Corp. in Natick, Mass. Revenue for nonelectromechanical relays, including both solid-state and hybrid devices, will climb from $127 million in 1987 to $244 million in 1991, estimates VDC analyst Daniel Kennedy.

Several factors are driving this growth. Chief among them is probably the increase in industrial automation, which, in turn, fuels demand for controllers between factory machines and host computers. Other influences include the flood of new telecommunications products such as facsimile machines, computer modems and multiplexers, all of which require switching devices — relays commonly — to provide phone line access.

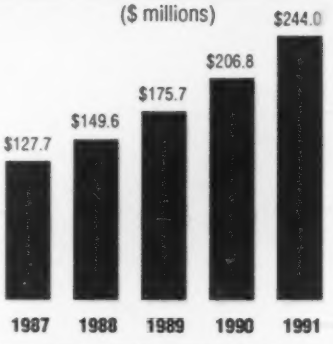
"The most significant part of our business is in input/output (I/O) modules for industrial automation equipment," says Robert Engman, president of Opto-22, a privately owned Huntington Beach, Calif., company and a leader in the field. Inexpensive personal computers have begun to replace programmable controllers as shop-floor brains for individual factory machines, he notes. Consequently, programmable relay modules have gained ground as they are increasingly being used as input/output devices to handle switching and communication between computers and machines.

"The main advantage of using relays on the factory floor is distributed intelligence," says Donald Long Jr., manager of the Florida Drum Co. plastics division in Pine Bluff, Ark. Long uses racks of Opto-22 relay modules to regulate process control and manufacturing equipment in the company's plastic drum plants. "We can have one computer controlling modules spread all over the plant," he says. "We could even use radio frequency modems to completely eliminate wiring." Before changing to PCs and relays, the company used programmable controllers permanently wired to individual machines.

In some cases, companies are bypassing I/O modules in favor of microelectronic relays. "Going to a simpler switch allows greater sensitivity and works well in noisy environments [prone to electromagnetic interference]," says Tom Cunneen, national sales manager for Theta-J Corp., a privately owned Wakefield, Mass., company specializing in microelectronic relays. In addition to factory floor applications, such relays are going into other kinds of industrial equipment such as gas pumps.

Nonetheless, says Engman, "we've seen a big increase in I/O modules in the last year or two," as companies ranging from industrial giants to small manufacturers raise their commitment to automation. He expects Opto-22 to generate more than $40 million in sales this year from a product line split almost evenly between low-power relays for printed circuit boards and heftier models for controlling larger-scale equipment.

Sales of U.S.-made relays



Figures are for nonelectromechanical relays, including solid-state and hybrid

Source: Venture Development Corp.

By and large, U.S. relay manufacturers are small or medium-sized privately owned companies. One notable exception is Eastman Kodak Co., which got into the relay business "by default," it says, because it couldn't find devices that fit the specifications for use in its own photocopying equipment. Another is Potter & Brumfield Inc., which was acquired several years ago by German electronics giant Siemens AG.

Prices are stable

"Prices have remained pretty stable for relays," says Darryl Bent, manager of Potter & Brumfield's solid-state product line. However, the company is bringing prices down, in some cases, by using contract manufacturing and by automating more of its own production facilities. "We're using more automation," he notes, "more automatic insertion, for example."

Other manufacturing trends include increased miniaturization. "We're trying to get more in less space," says Robert Ferran, vice president for marketing for Crydom Co. in El Segundo, Calif., the solid-state relay subsidiary of privately owned International Rectifier Corp. "We'll soon be introducing duals and quads — several relays in one hockey puck package," he adds, using the industry term for larger relays.

Another manufacturing trend is surface mounting of microcomponents — a technology that lends itself to more automated assembly. At Potter & Brumfield, for instance, the technology — which allows components to be inserted directly onto printed circuit boards — is rapidly gaining ground. "Now, 20% of our own products are produced with surface-mount technology internally; in a year, it will probably be 50%," states Bent.

Relay makers that specialize in microelectronic components are seeing demand start to grow for devices themselves suitable for surface mounting. "It hasn't been until the last year that we've seen customers actually go to surface mount," says Theta-J's Cunneen. "For now, it's mostly the biggest customers — they're the only ones who can afford it yet."

SARAH GLAZER

China is changing rapidly. Wan Runnan's Stone Group is emblematic of the shift toward private enterprise

High tech in China

The new private sector

BY AL FURST

Wan Runnan is the Steve Wozniak of China. Like Wozniak, who cofounded Apple Computer Inc. in a garage in Silicon Valley, Wan, 42, also comes from humble origins. But instead of a garage, Wan and six friends from the Chinese Academy of Sciences founded his computer company, Stone, in a shabby two-room office on a commune in the Western suburbs of Beijing.

Today, four years later, Stone is the largest independent computer company in China. Staffed by 700 employees, it manufactures and resells a wide variety of computers, peripherals, and electronic typewriters which can produce Roman characters on one setting and Chinese characters on another. It also claims 80% of the domestic market for software used in Chinese character processing — the equivalent to our word processing.

Success has come swiftly to Wan. In 1987, the privately held company — renamed Beijing Stone Group Corp. — had about $9 million in after-tax income on $137 million in sales, a fortune in a country where the average peasant earns $300 a year.

More importantly, Stone — one of the first privately held high-tech companies in China — has come to symbolize the increasing importance of free enterprise principles in what was once a wholly planned economy. While state-run enterprises account for 93% of China's $2.36 billion in computer production, and that percentage is not likely to decrease very much in the next decade, reformers in the government realize that they badly need to emulate Wan's entrepeneurial skills if China is going to be able to successfully-industrialize.

Risk-taker

Wan is a risk-taker in a society that doesn't like to take risks; a go-getter in an economy that sometimes seems like it's going nowhere; and an iconoclast in a country that refuses to break with its 5,000-year feudal tradition of regional bureaucracies. Because of this, Western multinationals say the emergence of Stone — and of private companies like Stone — bodes well for those who wish to do business in China. If Stone can succeed in China's byzantine commercial marketplace, then there's hope for American, European and Japanese firms.

There's also hope for China's domestic computer industry. In Beijing alone, there are now over 170 privately held high-tech companies operating on Zhongguancun, or "Electronics Street." And more privately

Using $5,000 in borrowed capital, Wan Runnan launched his company in 1984. Today it has sales of $137 million

held companies are springing up daily in other parts of China.

"In part, what we're seeing now is a real shift in the locus of technological development and dynamism, away from the bureaucratic, [state-run], traditionally administered research institutes," notes veteran China watcher Denis F. Simon, an associate professor of international business relations at the Tufts University Fletcher School of Law and Diplomacy. "The trend instead is more towards high-tech oriented companies, something akin to joint stockholding companies. These companies are outside the stranglehold of the Chinese bureaucratic organizations. They are keenly aware of technological developments outside of China, and they are trying to plug into them. And they are more attuned to market dynamics, including maintenance, service, quality and product differentiation."

Stone's contribution to the Chinese economy has not been lost on the Chinese either. In the past year, Wan, who quit his job in 1984 as the director of the Computing Center at the Chinese Academy of Sciences to launch Stone with $5,000 in borrowed funds, has joined the pantheon of new economic heros in China. He is lionized in the press. He is wined and dined by high-ranking Communists. He lectures at universities.

Management skills

Economic reformers in the government — who hope China can become a world power in consumer electronics by the year 2000 — believe entrepreneurs like Wan Runnan can provide the Chinese computer industry with badly needed management skills.

China has always been strong in basic research and development. It is applied R&D, the transfer of technology from the laboratory to the factory floor, where China falters. That may be one reason why the government is encouraging the public sector to emulate Wan's approach.

The only problem is that Wan's marketing savvy may be difficult to duplicate. In many respects, Stone's success story is a unique phenomenon. Realizing in the mid-1980s that the IBM Personal Computer was fast becoming the de facto PC standard in China, Wan struck a deal to import Japanese printers and typewriters which he redesigned to make them more adept at handling Chinese ideograms. Later, he arranged for Mitsui Co., the Japanese trading company, to build the printer under license, and Stone exported 10,000 of them to China at $500 apiece. Previously, the company had purchased printers at $1,400 apiece from Toshiba Corp.

Later, after a field trip to the United States, he branched off into electronic typewriters and computers — again specializing in products that could be specially tailored to the Chinese market. Now Wan, as president of the firm, operates a slew of subsidiaries — including a joint venture with Mitsui to manufacture Chinese-English electronic typewriters and a division in Shenzhen, a free trade zone near Hong Kong, which is run by his wife, Li Yu, a software engineer and a company vice president. Stone's other subsidiaries sell everything from test equipment to power supplies.

If Stone can succeed in China, then there's also hope for Western high-tech firms

The difference between Stone and the public sector, however, is like the difference between an automobile and an ox cart — which is still, incidentally, the main mode of transportation for some provincial high-tech companies. Like all Communist countries, China is state-run. A complex web of ministries and other government agencies sets priorities, establishes production quotas and tries to regulate demand. To ensure that the system works, everyone is guaranteed work. This is the so-called "communal rice pot" — out of which everyone eats — or, as it is more frequently known, the "iron rice bowl." Everyone in China is guaranteed a job, no matter how talented or ill-equipped they are to hold it; and everyone earns roughly the same wages, no matter how hard they work, or don't work, as the case may be. Naturally, with such disincentives for individual initiative, lethargy and bureaucratic wrangling has become a way in most state-run enterprises.

Along comes Wan

Then along comes Wan. One of the first things Wan did when he moved into a renovated five-story building on Zhongguancun, was put up a sign in the lobby: "Replace the iron rice bowl with a clay rice bowl." "The clay rice bowl is stronger than the iron one," Wan says, "but it can also break more easily. That is the risk factor." Without risk there is no profit.

In Wan's operation, managers and employees who do not perform up to company standards are terminated — until recently, an unheard-of concept in China. Those who do perform are rated by their performance and paid accordingly. Some employees can earn 10 times as much as others on the payroll. Moreover, the wages he pays — $32 a month for clerical staff to $108 a month for Ph.D.s —

Top 10 computer companies in China

1987 sales ($ millions)

1.	**Stone Group**	$137.1
2.	**China Computer Development Corp.**	$101.8
3.	**China Computer Technology Service**	$43.9
4.	**734 Factory - Electronics Ministry**	$42.9
5.	**738 Factory - Electronics Ministry**	$26.3
6.	**45701 Factory - Electronics Ministry**	$26.0
7.	**Shanghai Computer**	$22.7
8.	**Beijing Xintong Computer Technology**	$20.5
9.	**South China Computer**	$16.5
	Shandong Computer Service	$16.5
10.	**Fujian Computer**	$14.7

Source: *Computer Information*

are about twice the average wage in China. In an egalitarian society like China, this approach is positively revolutionary — or reactionary, depending on your politics.

Nevertheless, Wan's "contract" system — which has been endorsed by Communist Party General Secretary Zhao Ziyang and others in the highest levels of the Chinese goverment — does seem to be paying dividends. Wan says the firm earned $9.6 million last year, making it one of the more profitable firms in a desktop computer industry plagued by overcapacity at the low end.

But perhaps more importantly, the system is proving to be extremely productive. In 1987, top-ranked Stone had $205,000 in sales per employee, about twice the norm for the top 200 electronics companies in the United States and perhaps eight to 10 times higher than the productivity at many state-run Chinese electronics companies.

"We'll use 50% of our profit for further product development," Wan says. About 30% will go for medical and welfare benefits, including housing — which Stone must partly subsidize if it wants to lure capable workers away from state-run enterprises. (To this end, Wan is currently setting up a real estate division inside the company.) The remainder goes into the "bonus" pool.

Wan has also set up a pension plan for his employees. Retirement for males is 60 years of age; for women, 55. According to Wan, the benefits are "higher than those paid by state-run enterprises." But because Stone's future is riskier than that of his counterparts in the public, he also provides his employees with insurance — in the event he has to lay off some of his employees because of market conditions. That's not even a problem at state-run factories which are virtually guaranteed survival by the government, no matter how badly they perform. That may change if China ever enacts a national bankruptcy law, but for the time being, the public sector is still a much more secure place to work than the private one.

To the rescue

Fortunately for China, though, the public sector is getting more and more insecure every day. The winds of change are sweeping through the Chinese bureaucracy. In a controversial move, the Ministry of Electronics Industry, the main high-tech power base in China, merged this year with the Ministry of Machine Tool Building, the main power base for industrial manufacturing, and 1,000 state jobs were eliminated at the state level.

Nevertheless, resistance to change remains endemic. Although Stone is publicly applauded as a symbol of the new China, many bureaucrats at state-run computer enterprises are reportedly bitter about Wan's success. "They claim it's my fault that nobody wants to buy their products," Wan says. "They would prefer it if I sold lower quality products at higher prices."

Economic reformers hope Wan can provide China with badly needed economic skills

The state-run Science and Technology Printing Institute also recently made noises about suing Stone, which had recruited some its scientists, for alleged patent infringement — a charge that Wan denies

High-ranking government officials, however, are clearly on Wan's side. Earlier this year, the Yunnan Electronic Euipment Factory in southwestern China, a state-owned microcomputer plant that was in deep financial trouble, signed an agreement whereby Stone would take over the management and marketing functions of the factory. Among other products, the Yunnan plant manufactures B-25 workstations under contract to Unysis Corp. for the Chinese banking industry. The first thing Wan did, he recalls, was "break the iron rice bowl" by firing 50 workers and reorganizing the management structure of the plant. Today, he says, it's well on its way of meeting its revenue target of $27 million, double that of the previous year. "Wan is already having a very positive impact on our business," says Jean-Jaques Reymond, director of market development for the Pacific/Asia Division at Unisys.

Under the terms of the agreement, Stone is also eligible to acquire up to 10% of the firm's assets by reinvesting profits into Yunnan Electric over a five-year period.

Recently, Stone also struck a simi-

Welcome to Electronics Street

Just as Silicon Valley had its origins in Stanford University and Route 128 in the Massachusetts Institute of Technology, Zhongguancun, or "Electronics Street," is an outgrowth of Beijing's nearby Academy of Sciences, home for 80,000 of the nation's top researchers.

Former electronics vice minister Xie Gaojue says the district will get special treatment

On the street in Western Beijing are more than 170 high-tech companies, including Stone Group. Once viewed as a fringe area of the city — with possibly a flourishing illegal black market in computer chips — the district is now highly respectable.

This winter, then-Premier Zhao Ziyang even put the official state imprimatur on Zhongguancun by making a highly publicized visit to the district. Later, the Beijing Muncipal Goverment set up a special economic zone there, complete with special tax incentives for companies involved in the development of new technology.

"Areas like these will always enjoy preferential treatment," says Xie Gaojue, formerly a vice minister of the Chinese electronics industry. To date, 400 new firms have applied for licenses to set up shop in the zone. The city expects to receive about 1,000 applications by year-end. □

lar deal with the Institute of Machinery Manufacturing Technology in Shanghai, a powerful and innovative research institute and prototype manufacturing plant which was very strong in technology but weak in both management and marketing. The Institute produces excellent computers but sources say much of the product winds up sitting in warehouses because of the Institute's inability to properly market the hardware.

Meanwhile, Wan continues to cast around for new market opportunies. Recently, he opened a company in Hong Kong which includes a department for product development. Next year, for the first time, Wan plans to market some of his products in North America. And he's even looking at the possibility of opening a company in the United States. His goals are modest — about $5 million in sales — but if he succeeds, he will be one of the first Chinese computer manufacturers to sell product in America.

It will not be easy, but Wan — who works 80 hours a week, sees his son in Shenzhen once a week, and spends his spare moments playing bridge or watching sports programs on TV —is used to new challenges. Wan says that one of the reasons he named his company Stone was because he liked the sound of the English word and because there is a peasant saying in China which captures the spirit of his enterprise. "When you go out into the dark night," Wan says, "the first thing you must do is throw out a stone to see where the road is." □

Tips on doing business in China

Reto Braun, president of the Pacific/Asia Division of Unisys Corp., which currently works with Stone Group to manufacture B-25 workstations at the Yunnan Electronic Equipment Factory in southwest China, offers the following advice to U.S. high-tech companies doing business in China:

First, a high-tech firm has to recognize it is likely to be dealing with a lower level of customer knowledge than in a consumer business, for example. In fact, it will often find itself marketing complex products to inexperienced customers through experienced third parties.

This leads to the **second** point. A high-tech firm is often confronted with a desire for higher level technology than is needed, higher than can be operated and maintained adequately and higher than can readily be cleared through the export licensing procedures.

A companion **third** point: High-tech firms will find the Chinese expecting to save money, particularly foreign exchange, on maintenance costs. They'll want to do maintenance themselves, often without adequate experience or appreciation of the magnitude of the task. This is a great concern for firms which must energetically protect the reputation of their products for performance in the field.

Fourth, the rapid change of regulations relating to importable levels of technology, duties and taxes is likely to have greater impact on a high-tech enterprise. There is a high capital-to-labor investment ratio in China and a need to amortize expensive tooling and training. Stability in the market conditions may be more important.

Fifth, communications is a special concern for high-tech enterprises. The complexity of products or manufacturing processes puts a high premium on good understanding and rapid, direct interaction — at all points — language comprehension, physical facilities and effective training.

Reto Braun of Unisys

Sixth: For firms selling major high-tech systems into the PRC, it is important to educate the Chinese to the need for systems studies before making commitments to complex installations. Only a few people in China yet recognize that they must face up to the cost of contracting outside expertise to make such studies. Know-how to optimize systems is at least as important as buying hardware.

Seventh, high-tech activity brings with it an extra measure of bureaucratic complexity on both sides of the Pacific Ocean. On the Chinese side, there are additional agencies concerned to supervise and monitor and coordinate and clear. On the U.S. side, there is the control of advanced technology in the interests of national security. Knowledge of this bureaucracy is mandatory.

As the experience of Unisys and other companies has shown, it is definitely possible to succeed in China today. However, it is a most difficult challenge. It requires great commitment and patience — even though a reasonable business return cannot be deferred forever in pursuit of a great and distant potential. Companies are not governments. The Chinese government must accept the necessity of establishing and maintaining conditions that recognize the legitimacy of a reasonable business return and permit such a return to be earned.

And finally, **eighth**, I would like to make several specific suggestions which experience suggests could be useful to each side as a practical road map:

- Go for a level of technology which is proven. Proven does not mean obsolete. Proven technology is state-of-the-art technology. It must be technology that can be assimilated by the Chinese side, and which is licensable by the United States or another Western country.
- Next, I suggest that one check early with Washington, or your own national licensing board authorities, to verify the licensable level of exports.
- Then prepare to put special effort into education at all points with your Chinese collaborators and their market. This effort should cover the product, its assembly or manufacture, quality assurance, its selling strategy and field marketing, and maintenance. □

America's electronics sector is putting a new value on its patents and copyrights. It's not just a job for the lawyers — it's management's priority too

Management's new cry: Fight for your technology rights!

BY JOHN KERR

You've just spent your life savings and a decade developing the Wonder-Chip, an outstandingly novel microprocessor that tests itself, repairs itself, resists nuclear radiation and handles trillions of instructions per second. The military and the big computer makers are beating a path to your door, and the OEM orders are flooding in. Drinks all around.

But suddenly you're not buying anymore. You've just gotten word that you're being sued for patent infringement by one of Japan's largest chip makers.

Welcome to the real world — a world where protection of intellectual property has become a distinct strategy for top management in the electronics industry. Where lawsuits fly thicker than ever and senior executives worry about their intellectual property walking out in the heads of their top designers. Where foreign firms pirate U.S. technology without shame. Where Japan fiercely protects its own technical rights. And where, some say, litigation is used as a marketing tool.

We're not talking about pennies here. In 1986 — the last year for which information is available — a sample of 48 U.S. computer, software and electronics companies reported losses of $6.5 billion in revenue as a result of intellectual property infringement, according to market researcher Dataquest Inc. That's an average loss of $135 million per company.

While legal maneuverings over software copyrights have made most of the headlines — and will continue to do so as firms increasingly file for patent protection instead of copyright — there is also furious activity in defense of hardware rights.

Protection of the collage of patents, trademarks, copyrights and other legal tools with which a company attempts to defend its technology is central to the philosophy of many senior electronics executives. "It's a key requirement for success — as long as it's used right and on a timely basis," says Philip White, president of PC and terminals maker Wyse Technology of San Jose.

Hitachi's No. 1

That message has not been lost on the Japanese. Witness the change in the rankings of the top 10 corporate holders of U.S. patents: in 1975, the top three were General Electric Co., E.I. du Pont de Nemours & Co. and Westinghouse Electric Corp. In 1986, reports the U.S. Patent and Trademark Office, Hitachi Ltd. topped the list, ahead of GE, which led Toshiba Corp. by a whisker.

Higher visibility for intellectual property protection is manifest in the surge of business seen by both independent and in-house patent attorneys: San Francisco law firm Limbach, Limbach & Sutton has expanded from two lawyers in 1968 to 30 now, largely on the strength of Silicon Valley's concern over property rights. Wyse, for instance, is utilizing more outside counsel than ever. Peripherals-products maker Western Digital Corp. of Irvine, Calif., is trying to recruit an in-house patent lawyer.

And this trend is evident in the upsurge in patent judgment appeals passed on by U.S. district courts to the U.S. Court of Appeals, Federal Circuit (CAFC), in Washington: up from 172 in 1983 to 246 in 1987.

A sound strategy for property rights defense involves decisions on everything from filing in the countries where it will do the most good to laying out trade secrets guidelines that help keep key employees; from tactics for boosting short-term income from licensing fees to pushing patents on software. It means knowing when to push and when to negotiate, what to second source, and where.

It has been that way for decades in the pharmaceutical and chemical industries. Electronics giants like IBM and General Electric Co. have been able practitioners for at least as long. "We've always considered intellectual property to be important," says Jan Jancin, a counsel on intellectual property law at Big Blue's corporate headquarters in Armonk,

PART I: THE PROBLEM

As U.S. firms struggle to remain competitive, intellectual property protection has become a critical concern. This overview is the first in a three-part series on the problems of technology loss — and the solutions. Subsequent issues of ELECTRONIC BUSINESS *will detail how some companies are overcoming these problems and also provide expert advice on how you, too, can keep control of your technology.*

N.Y. But only in the past few years has the issue received star billing in the electronics industry at large.

The degree of concern varies from industry sector to sector: in desktop computer microcode, for example, the issue is white hot; in disk drives, where an electromechanical bias prevails, it's less so. That is changing, however, as drives take on more intelligence. "We haven't done as good a job of patenting some things as we should have," confesses Finis Conner, CEO of 2-year-old drive maker Conner Peripherals Inc. of San Jose.

Others have neglected to renew patents, or ignored technology that might have applications in future corporate moves. Some show ignorance of foreign rules; for example, filing patents in Japan without planning to market there near term. That way, they leave themselves open to trespass when, under Japanese law, the patent is opened to public scrutiny after 18 months if not awarded by then. And still others wrongly view intellectual property protection as a one-off operation instead of an ongoing strategy.

Small firms wise up

But even the smaller electronics firms are wising up. A recent survey by ELECTRONIC BUSINESS of companies in this category — 91% with annual revenue below $10 million — shows strong awareness of and interest in protection of intellectual property.

In a telephone poll of 100 senior executives, 93 of whom are presidents of their firms, only 6% said that they were suing to protect their technology. But 58% claimed to be bringing more of their engineering work in house, while 36% said they were reducing second-sourcing agreements for fear of technology leaks. And 71% reported that they were providing extra incentives to retain key technology employees. Only 10% admitted that they were doing nothing to protect their intellectual property.

It wasn't that nobody cared about their technology before the 1980s. It was simply that it wasn't perceived as the most pressing issue. But a rapidly shifting business environment is forcing that notion to change. William Keefauver, an AT&T vice president and the company's top lawyer, cites three reasons: a significant gain in the competitiveness of foreign nations, coupled with an upsurge in counterfeiting; a higher proportion of a vendor's added value found in software; and a radical ruling in 1982 that created the CAFC — a body that has consistently upheld the value of patents.

Patents didn't count for much prior to that; as much as 70% of all patents were found to be invalid when tested in court, largely because the courts ruled in favor of dissemination of technology. "During the 1960s and 1970s, the concern was over monopolies. But that concern has largely disappeared," explains Oliver Smoot, executive vice president of the Computer and Business Equipment Manufacturers' Association.

Hence, the spirited patent defenses mounted in recent years: Texas Instruments Inc. vs. eight Japanese and Korean chip makers over DRAM patents; Cipher Data Products Inc. vs. Wangtek Inc. over the 5.25-inch form factor for quarter-inch tape drives; IBM head-to-head with Nashua Corp. over floppy disk patents.

The story's much the same in the copyright arena. Fujitsu Ltd. lost out to IBM over operating-system software copyrights. Intel Corp. and NEC Corp. are presently locking

Terry Widener

horns over semiconductor microcode. And Apple Computer Inc. is suing Hewlett-Packard Co. *and* Microsoft Corp. over its rights to full copyright authority on windowing software.

It's evidently worth it to many. Last year alone, Texas Instruments garnered $191 million in settlement costs from the Far Eastern dynamic RAM makers. And when Polaroid Corp. sued Eastman Kodak Co. for $5.7 billion over the rights to make and sell instant cameras, eyebrows climbed foreheads. "That showed you could lose a ton of money and market share if you didn't care too much about your intellectual property," reports AT&T's Keefauver.

The courts are not the only method being used to hash things out. Many companies are using independent arbitrators; others find use for mediators not unlike those used in labor versus management wage disputes.

IBM gets tough

The pace of intellectual property protection is hardly slowing. Indeed, quite the reverse appears to be true. "The patent budgets of several of my clients are up significantly," reports David Lovejoy, partner at San Francisco law firm Fliesler Dubb Meyer & Lovejoy. And just look at what Big Blue is up to. IBM doesn't put it in these terms, but it has by any measure become much more aggressive in going after what it believes it is due. In May, it began demanding that PC clone makers pay retroactive licensing fees. This, after its April increase in licensing fees on its worldwide portfolio of 32,000 patents.

Under the new rates, licensees still pay 1% tops on sales revenue on a product using a single IBM patent. But since April 8, they've felt the bite as the previous maximum 1% rate for multiple and varied patent use has swollen to 5%. "This better reflects the value of that technology to licensees, and put IBM more in line with other companies," explains a spokesman.

If anyone still doubts that intellectual property protection is not for Mahogany Row, hear this: IBM chairman John Akers was instrumental in the decision to hike royalty rates. IBM has even warned competitors that it considers RISC technology to be IBM technology. Rivals not paying royalties could be infringing on IBM patents, according to company.

IBM adamantly refuses to disclose how much more it will glean from its move to increase revenue by licensing all its technology. But it will clearly run into millions of dollars annually. RCA Corp., now part of GE, holds over 1,000 patents in video technology and derives from them $150 million in yearly royalties.

However, not many companies admit to developing patent portfolios solely to generate revenue. "We don't do it to make money," remarks Wyse's White. Adds Conner of Conner Peripherals: "Patents to me are more for negotiating purposes than for revenue streams."

Cross licensing of technology is a favorite tactic of those with fat patent portfolios. And it's as good a reason as any for building up such a portfolio. "Our strategy is to build up a decent patent portfolio," claims Irwin Kwatek, vice president and general counsel for Western Digital. The more patents you have, he reasons, the more easily you can deter those threatening trespass on your technological turf. And the more you can trade technology without having to reinvent wheels.

Western Digital's strategy involves a program to encourage engineers to patent their inventions. Half of a $4,000 award is handed out when a patent is applied for, the other half a year or two later when the patent is granted.

Gallium-arsenide chip maker Triquint Semiconductor — a Beaverton, Oregon-based spin-off of Tektronix Inc. — also wants to build up a patent portfolio, but president Alan Patz doesn't hold with cash incentives be-

Legal-speak: A glossary of intellectual property jargon

- **Intellectual property**: Copyrights, patents, trademarks, trade secrets, semiconductor mask works, proprietary technical data, and other proprietary (and often intangible) entities to which companies have unrestricted and exclusive rights of ownership.

- **Trademark**: Any word, name, symbol or device, or any combination thereof, adopted and used by manufacturers or merchants to identify their goods and distinguish them from those manufactured by others.

- **Copyright**: Protection provided by a national government to authors of original works. The owner of copyright has the exclusive right to reproduce the copyrighted work; prepare derivative works; and distribute copies.

- **Patent**: A grant issued by a national government conferring the right to exclude others from making, using or selling the invention within the national territory. (One kind — utility patents — are what IBM licensed with its PS/2 to cover functions or processes, but not specific designs.)

- **Trade secret**: Information, including a formula, pattern, compilation, program, device, method, technique or process, that derives independent economic value (actual or potential) from not being generally known, and is the subject of efforts that are reasonable under the circumstances to maintain its secrecy.

- **Semiconductor mask work**: A series of related images, however fixed or encoded, having or representing the predetermined, three-dimensional pattern of metallic, insulating, or semiconductor material present or removed from the layers of a semiconductor chip.

- **Proprietary technical data**: Data submitted to a government agency in connection with the regulatory review of a product.

- **Source**: U.S. International Trade Commission report on "Foreign Protection of Intellectual Property Rights and the Effect on U.S. Industry and Trade" and "Intellectual Property Rights: Global Consensus, Global Conflict" (Westview Press, 1988).

M.J. FOLEY

cause he believes that's a quick way to end up with technology that isn't easily commercialized — or licensed. But he did, soon after Triquint's inception, put in place a definite strategy for protection of intellectual property. "We made a decision very early on that we had to have it," he says.

Implementation of that strategy has meant formulation of a framework for teaching key supervisors the procedures for filing patents, the types of inventions that patents can be filed on and the technologies that Triquint will keep as trade secrets.

United States patent applications filed by residents of foreign countries

Residence	1984	1985	1986	1987
Britain	4,482	4,473	4,862	5,173
Canada	2,539	2,570	2,700	3,072
France	3,481	3,801	4,032	4,069
Italy	1,802	1,799	1,879	2,054
Japan	18,289	21,669	23,491	25,022
Netherlands	1,227	1,336	1,350	1,410
Sweden	1,408	1,429	1,407	1,311
Switzerland	1,843	1,966	2,021	1,975
West Germany	9,551	10,722	10,630	10,951

Source: U.S. Department of Commerce

Japan and Germany continue to dominate the list of foreign patent holders

Too aggressive?

Strategy or not, there are those who question the rightness of the new aggression in protecting a company's technology rights. "Many people feel that Apple is going way too far," claims LeRoy Rahn, a partner at Pasadena, Calif., law firm Christie, Parker & Hale, in reference to Apple's feud with HP.

There's a sense that all that time spent in court — or in arbitration — is time and energy that could better be spent in advancing the company in other ways. An engineer's time spent agonizing over whether his or her design might infringe on someone else's technology is not as productive as it might be.

There's also a sentiment that perhaps some of the larger companies are going too far. One small California peripheral maker, sued by Digital Equipment Corp. for an alleged technology infringement, told ELECTRONIC BUSINESS that it believed that DEC was using litigation as a marketing tool, the implication being that the longer DEC could stall the little company's products, the sooner it could get its own to market. DEC denied the charges.

Other observers maintain that courtroom tactics are sometimes battles for honor and sometimes publicity stunts. At the least, they indicate, the suits are a means of putting the brakes on the competition.

Blood lust

So, have large electronics companies acquired a blood lust? And do they have an advantage over smaller firms when it comes to protecting their intellectual property? The jury's still out on that one — and will remain so. "The larger companies have the money and the lawyers to protect themselves during legal battles," says one respondent to ELECTRONIC BUSINESS' poll of small firms; "The large companies are already in partnership with the foreign pirates," snipes another. At issue is the well-being of the small companies that are acknowledged to be the wellspring of technological innovation in America.

But other respondents agree that the large firms have more to lose, the corollary being that small companies can lie low. That's been true for Tustin, California-based chip maker Silicon Systems Inc., which this year will

The perils of second sourcing

As manufacturers get caught up in the heat of intellectual property protection, second sourcing — once an industry standard — seems to be falling from favor. "Too much second sourcing is not a good thing," says Thomas Dunlap, vice president and general counsel for Intel Corp.

Intel recently announced that its new embedded control products would not be second sourced. Intel's not saying whether the decision was made because it was burned by two now-sour relationships with NEC Corp. and Advanced Micro Devices Inc., or simply because it doesn't need a partner.

But, clearly there is a trend away from second sourcing. "There has been a drop-off in second-sourcing agreements," notes Dataquest Inc. senior analyst Alice Leeper. A recent survey by ELECTRONIC BUSINESS confirms that many companies are cutting back on second-sourcing deals for fear of technology leaks.

"Most of the hot [microprocessor] products right now don't have second sources," adds Leeper. The ones that do are from the new companies like Sun [Microsystems Inc.] and MIPS [Computer Systems Inc.], because they have new technologies that need to be established." Large companies, it appears, can forego second sourcing, while smaller companies must risk losing intellectual property rights to survive.

Yet, second sourcing will continue. Even some large companies, notably NEC and AMD, continue to champion the need for second sourcing, particularly as a way to give the customer a better selection of products — and more competitive pricing. "If you could do it all yourself, that would be great," NEC senior vice president Hank Josefczyk says. "But the increasing complexity of the industry and the products will continue to encourage partnerships."

VALERIE RICE

run up annual revenue of about $115 million. The 15-year-old company has only seen infringement notifications in the past year or so. "Your silhouette as a target goes up with size," observes senior vice president Martin Jurick.

However, there's a quick answer for those pinning ulterior motives on large companies' legal actions: "If you've worked long and hard to develop products, you have a right to protect them," states Wyse president White.

It's not cheap to do so, however. Which raises the issue of how much electronics companies should spend on protecting their intellectual property. Should patent departments be run as profit and loss centers? Few are, since it's so tough to assess a company's fiscal status with and without patent, copyright and trademark protection. However, several top corporate lawyers indicate their worth comes under scrutiny from management: "You can't avoid showing up as a cost," says AT&T's Keefauver, whose department includes 70 lawyers. □

The case of the walking brain

The electronics industry is an incestuous business. It is difficult to imagine it any other way. Where, for example, would the semiconductor industry be if a handful of employees hadn't left Fairchild Semiconductor Corp. to give birth to Advanced Micro Devices Inc., or Intel Corp.?

It is that entrepreneurial spirit — and mobility of talent — that has enabled the American electronics industry to flourish. But the process is not without its potential pitfalls. Trade secret theft by former employees is a concern at any high-tech company.

"Proprietary information is more dear than anything you have," says Gerard H. Langeler, president and COO at Mentor Graphics Corp., in Beaverton, Ore. Mentor has been on both sides of the trade secret fence, first as a start-up that spun off from Tektronix Inc., and then as a claimant in a case against former Mentor employees. In the first case, says Langeler, he and Thomas H. Bruggere, Mentor chairman and CEO, left Tek without a product in mind and with little reason to be accused of trade secret theft. But when the time came to determine Mentor's strategy, he and Bruggere thought carefully about whether or not Tek would have any reason to be upset with its two former employees.

Sending a warning

In the second case, Mentor sued four employees at EDA Systems Inc. They were able to settle out of court due to a noncompetition agreement one of the four had signed while at Mentor. According to Langeler, the suit was well worth the cost. In addition to settling that particular case, says Langeler, "you send a signal letting people know you won't let [trade secret theft] happen at your company."

Equally concerned are employees, who feel that they have a right to benefit from their own ingenuity. The Institute of Electrical and Electronic Engineers (IEEE) is endorsing legislation that would limit the rights a company has to its employees' inventions. "Most companies have very restrictive agreements that restrict innovation," says Stewart Bjornsson, chairman of the IEEE's Intellectual Property Committee. "Employee agreements have been used to squelch start-ups."

"Proprietary information is more dear than anything"
Mentor's Gerard Langeler

Trade secret litigation has hit something of a plateau since the early 1980s, when there was a significant rise in such activity, says Robert Alan Spanner, a partner with Beckford and Spanner, a law firm in Palo Alto, Calif. In 1983, for example, IBM sued Cybernex, a thin film media start-up founded by former IBM employees. In 1985, Apple Computer Inc. sued Steven Jobs for "secretly scheming" to misappropriate proprietary information about the company's next-generation computer. And, in the same year, Digital Equipment Corp. sued Emulex Corp., a Costa Mesa, Calif., maker of DEC-compatible storage technology for both trade secret theft and patent violations.

Most settled out of court

Things could heat up again, especially in highly competitive markets. "When competition is more intense, corporations are more nervous about losing trade secrets," says Steven J. Frank, an attorney with the high-technology group at Nutter, McClennen & Fish, in Boston. Indeed, some of the still-pending trade secret cases are in the hotly contested fields of software and artificial intelligence. Still in litigation, for example, are Computer Associates Inc.'s charges against two former employees for allegedly stealing trade secrets when they left for Duquesne Systems Inc. And Teknowledge Inc. has sued its former vice president for engineering, who subsequently founded Coherent Thought.

Most cases, though, are settled out of court. "Electronics is a very transient industry," says Rob Paglierani, intellectual property attorney at Prime Computer Inc. "The same thing could happen to us. Someone could come to work for Prime and we could find out they have taken something from their former employer. We don't want to get the reputation for coming out with all guns blazing," says Paglierani. "We may be the victim, too. We try to settle things amicably."

Still, says Paglierani, "there may come a time in the life of Prime, and in the life of every high-tech company, where we will have to sue because the information taken is vital to the company."

ANNE KNOWLES

IBM's PS/2 falters in the federal market

The biggest microcomputer market, the U.S. government, is not convinced PS/2 and OS/2 are the way of the future

BY JOHN M. DODGE

IBM is winning corporate customers with the seven-model PS/2 line, but the story in the less dynamic and more cost-conscious federal government market is dramatically different.

The Personal System/2 is primarily responsible for IBM's inability to hang onto a bigger piece of the single biggest microcomputer market. With PS/2s come an untested hardware architecture, peripherals that are incompatible with the existing PCs, relatively high prices and no solid alternative sources for the machines. Clearly, IBM will be challenged in winning over the Feds, especially the military.

To propel the PS/2 into standarddom, IBM is counting on widespread acceptance of OS/2, a powerful new operating system it is codeveloping with Microsoft Corp., of Redmond, Wash. Various releases of OS/2 will be shipped during the second half of this year, but it may be as many as two or three years before OS/2 takes off. Even without OS/2, IBM claims to have shipped 2 million PS/2s. From all indications, though, only a tiny fraction has been sold to federal customers.

As a microcomputer supplier, IBM was a distant No. 2 in the federal market last year. The General Services Administration (GSA) pegs IBM's share at 9.6% (just over 19,000 units) of the estimated 200,000 PCs purchased in the fiscal year ending Sept. 30. By comparison, the runaway leader, Zenith Data Systems, delivered 116,984 units for 59% of the 1987 market, GSA reports.

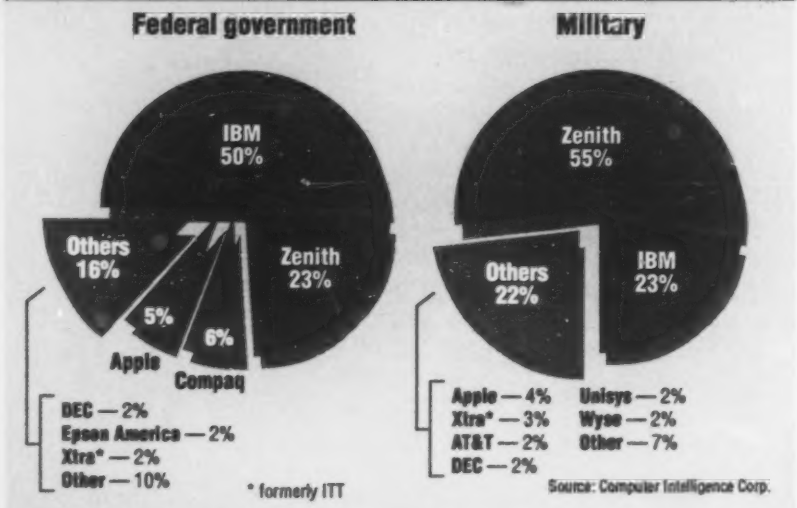
Maj. James McConeghy, small computer program officer for the U.S. Air Force, would dispute some of the GSA statistics. He estimates the military alone has 800,000 PCs. However, the Defense Logistics Agency, the source of the GSA's Department of Defense numbers, reported that the military owns 334,494 microcomputers. GSA survey manager Irene Bayol explains the accuracy of the survey report relies on responses from the various agencies, and as a result some machines might be omitted.

Sheer size alone — the government has 4 million employees — and IBM's huge government presence in mainframe computers and other data processing systems are two reasons why IBM's competitors are convinced the company will try to come roaring back with the PS/2. A recent GSA report says the number of microcomputers bought by the federal government in 1987 tripled over 1985 and that the agency's 1982 forecast — that the government would be using more than a million micros by the early 1990s — is on target. The report, which surveyed 77 agencies, says the government spent $694 million on microcomputers in 1987 and that the total installed base of 490,400 units is presently worth $1.78 billion.

Just the beginning

"It takes some time to build [demand] up. We are just beginning to see specifications for PS/2 functionality," according to Marvin Summers, manager of procurement contracts for IBM's National Federal Marketing division in Bethesda, Md. IBM claims that the advantages of the PS/2's Micro Channel architecture will become apparent when OS/2 takes off late this year. Consequently,

Installed base of PCs in government and military markets



IBM has half the PCs installed in the federal government, but only about a quarter of the military PC market

marketing pushes will emphasize the higher end of the product line, Models 50, 60, 80 and the new 70, rather than the Models 25 and 30 which cannot run the new operating system.

"IBM is very well thought of in the government, but I hear from customers that they are ignoring their installed base in their desire to establish a new expensive architecture. They cannot compete in the open architecture they established. I think they may be willing to walk away from some of the low margin business," posits a major competitor.

IBM won't publicly surrender the low-end business, but a company spokesman concedes that the more powerful and expensive Models 50 and 60 are selling best in the government. "As OS/2 software comes onto the marketplace, the PS/2 standard will come into its own . . . PCs are water under the bridge," says the spokesman.

That prediction is not shared by all. "We are not as sanguine about OS/2 as perhaps IBM is. The software is a lot more difficult to keep up with than the hardware. OS/2 has not done much in the [federal] government at all," says Roger Cooper, assistant deputy secretary of information systems at the Department of the Treasury, which according to the GSA is the biggest microcomputer user among civilian agencies.

PS/2 sites

The Internal Revenue Service, which is part of the Treasury, is one of the largest users of PS/2s, but according to Cooper, they were substituted to fill existing contracts for PC ATs which were all but pulled off the market to make way for PS/2s. In some cases, the PS/2s were priced below comparable ATs, Cooper adds. The prime contractor, Virginia-based systems integrator Sysorex, installed the systems in IRS Service Centers as data entry terminals.

Later this summer, the Treasury will award a $380 million microcomputer contract for 80386 and 80286 PCs, Apple Computer Inc. Macintoshes and local area networks, according to Cooper. IBM would not divulge whether it's bidding, but Cooper says he assumes IBM would not ignore such a lucrative contract.

Another comparatively large PS/2 site is the Department of Energy, where more than 500 machines are

in service, according to Philip Kief, DOE assistant press secretary. As with the Treasury, the machines were "technical upgrades" and are fulfilling a five-year, $30 million contract for 4,900 units, which IBM won in 1984 and which originally specified IBM PCs, Kief adds.

Other populations of PS/2s tend to be small. For example, the Department of Agriculture (USDA) is buying 15 Model 30s through a subcontractor for an Agricultural Stabilization and Conservation Service program, says Ray Suehr, leader of ASCS contracting services. The USDA presently buys 80286 and 80386 PCs through a $223 million contract with AT&T.

IBM won't reveal whether PS/2s have landed anything bigger than a GSA schedule, or contract, which generally range from $20 million to $30 million, according to Tom Buchsbaum, vice president of Zenith Federal Systems in Vienna, Va.

Military market

The military, which the GSA says accounts for 68% of all government-owned microcomputers, will be even a tougher market for IBM to crack. First, the military already favors Unix, a major competitor to OS/2. Second, whether the military likes OS/2 or not, it will be at least six months to a year before enough about it is known to get officials to buy into it. That's valuable time IBM loses to competitors. Third, the military is making one of the stronger bids in the government to standardize software and hardware and the PS/2s represent a departure from existing PCs.

Another problem is more basic — price and performance. PS/2s are more expensive than other microcomputers, although prices were recently cut and faster models (the Model 70-A21 at 25 MHz is an extremely fast 80386 PC) were added

IBM's federal future

IBM's share of the military microcomputer market will drop precipitously during the next year, predicts Computer Intelligence Corp.

The La Jolla, California-based market research firm conducted a telephone survey of 1,200 federal computer sites. In the overall federal market, IBM's microcomputer share will decline sharply, according to the CIC survey. IBM microcomputers represent 50% of the installed base, but during next year, 29% of the 600 sites with purchasing plans said they will buy Personal System/2s, says Tom Young, CIC PC analyst. Zenith Data Systems scored 35% of the mentions.

IBM can claim 23% of the military's microcomputers; Zenith, 55%. For military sites with purchasing plans for the next year, IBM was mentioned by 10% of the respondents; Zenith, by 68%.

The trend for IBM is much brighter in the corporate marketplace, CIC notes. Of the 8,000 sites surveyed also by telephone, IBM was responsible for 72% of the unit volume with 91% being PCs and 9%, PS/2s. Of the sites with buying plans, IBM garnered 76% of the mentions, showing strong support for PS/2s.

Certainly IBM would like to enjoy the same level of support in the federal government. But establishing the PS/2 as a hardware platform is a huge gamble, which has cost IBM a very strong position in the federal PC market. The challenge — significantly differentiating the PS/2 from the PC — apparently won't happen until OS/2 is proven and easy to understand in terms of applications. □

Tom Barrett

to the line. "I don't think [the PS/2] will do well until it competes from a price/performance standpoint. That's an absolute requirement," comments an Army program manager in charge of small computer acquisitions.

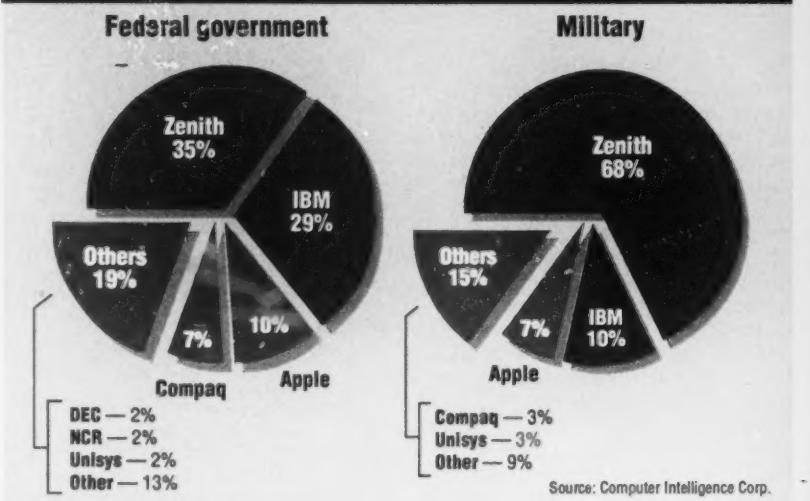
"There's nothing really pushing in the direction [of OS/2]. There's no lure for it. A lot of people [in the military] are keen on OS/2, but is there a functional requirement for it? It's too early to tell," says the Air Force's McConeghy, speaking from his office at Gunter Air Force Base in Montgomery, Ala.

Conversely, Unix is a proven multitasking operating system that is beginning to successfully address its major drawback, user unfriendliness. Unix already runs on the thousands of DOD minicomputers. The extent to which OS/2, which is not multitasking, is portable is an unknown, McConeghy points out. And the operating system's performance in conjunction with local area networks, an increasingly important consideration, is another OS/2 question mark, McConeghy adds.

"In a time of war, if the military has to withdraw from a foward to rear area, they want to be sure software that runs on one set of computers runs on all their computers," Zenith's Buchsbaum explains. This notion is known as "scalability" or "interoperatibility," which means, for example, that Unix applications that run on Digital Equipment Corp.'s minicomputers can be easily ported to microcomputers.

The PS/2 is not the first time IBM has launched a new hardware architecture without the required supporting software to make it a standard. When the original PC hit the ground, there was a paucity of software applications, although the DOS operating system was firmly in place. Whether history can repeat itself in the federal market, where the IBM PC was a smash hit, is questionable. □

Purchasing plans for PCs in government and military markets



Source: Computer Intelligence Corp.

Zenith PCs will be the most popular purchase with the federal government and the military next year

Zenith's crown jewel

The number of PCs that Zenith Data Systems has sold to the federal government is staggering.

The crown jewel in the profusion of highly profitable contracts Zenith has won is the Z-248 standard desktop contract to the Air Force. To date, Zenith has delivered 240,000 of the Z-248 80286-based PCs worth $715 million to the Air Force and the rest of the military which also buys from the contract, according to Maj. James McConeghy, USAF small computer program manager at Gunter Air Force Base in Montgomery, Ala.

"They have put forth an excellent technology and priced it very competitively. They priced the AT like an XT," McConeghy explains. The units range from $1,100 to $1,800, depending on storage and memory options.

In 1987 alone, Zenith sold PCs, related peripherals and software worth in excess of $500 million, says Tom Buchsbaum, vice president of Zenith Federal Systems in Vienna, Va. "We are quiet about it and we compete real hard," Buchsbaum says modestly about his company's success.

Zenith owns close to 60% of the federal micro market

The General Services Administration (GSA) reports that Zenith owned close to 60% of the federal market in 1987, supplying 117,000 of the 200,000 microcomputers the government bought. The Illinois-based company has also nailed down bids with the House of Representatives, the Internal Revenue Service and the U.S. Air Force for tens of thousands of laptop computers, and has an ongoing contract with the Navy and Air Force for 49,000 Tempest Z-150 and Z-200 PCs, 20,000 of which have been delivered.

The next mega-contract is what is known as Desktop III, which could call for as many as 200,000 to 300,000 desktop computers, says Buchsbaum. "I would not be surprised to see IBM competing for that." It's likely that Zenith and other experienced government contractors such as Compaq Computer Corp., Epson America Inc., NCR Corp., Unisys Corp., Wang Laboratories Inc. and Wyse Technology, will compete for it as well.

How long can 380MB drives keep spinning so fast?

The big drives may be in hot demand today, but manufacturers already need to watch tomorrow's needs — and keep an eye on what IBM, DEC and HP are up to

BY BRIAN DEAGON

The market for 380-megabyte hard disk drives, previously characterized as one of great stumbling and confusion, found its stride in 1988. Manufacturers and market analysts see it as a major growth industry for at least the next three years.

Signs of a robust market are evident. Almost every major disk drive supplier is shipping products, including Control Data Corp., Hewlett-Packard Co., Maxtor Corp., Micropolis Corp., MiniScribe Corp. and Priam Corp. Major system manufacturers routinely integrating the drives into their systems include AT&T, Apollo Computer Inc., Compaq Computer Corp., Sun Microsystems Inc. and Unisys Corp.

"It's an industry standard for us," says George Gardner, Apollo Computer product manager of personal computer workstations. Apollo has had engineering teams evaluate the drives intermittently for more than a year. Their most recent report was "very positive," says Gardner.

But for all the enthusiasm, it is a sector fraught with anxiety for the executives of those drive makers — and for management at the computer systems firms using the big drives. As demand ramps up, adequate sources of disk media and recording heads become crucial. And the influence of big users like Digital Equipment Corp. and large-scale rivals who also use 380MB drives, like HP, are issues that have industry executives on edge.

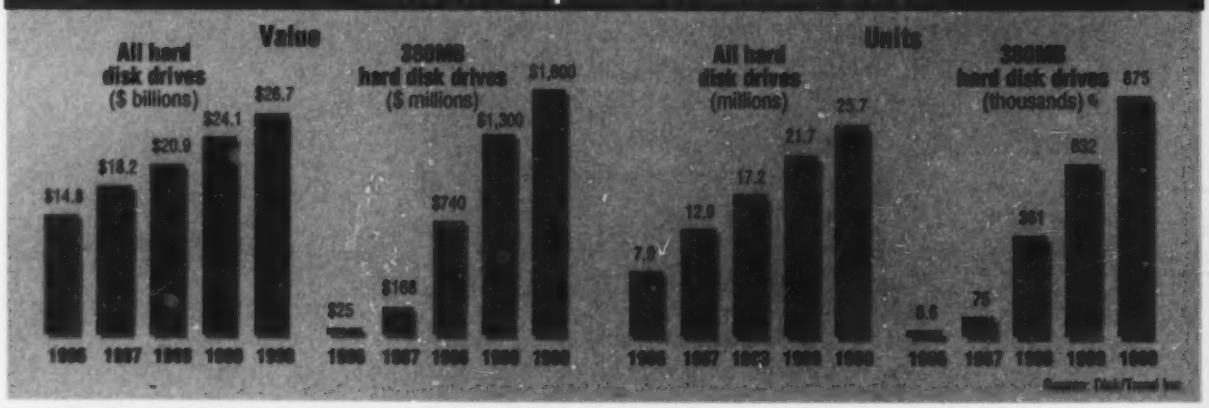
The development of 380MB drives was beset with problems early on. A critical shortage of recording heads and disks needed to build the drives forced layoffs and caused financial woes. Those problems have been resolved and disk drive vendors are rapidly expanding production capability to meet demand.

Worldwide shipments of 380MB drives increased to 75,000 units in 1987, compared with 8,600 in 1986. By 1990, shipments will increase to 875,000 annually, reports Disk/Trend Inc., a market research firm based in Mountain View, Calif. Sales of the drives will increase to $1.6 billion by 1990, up from $168 million in 1987 and $25 million in 1986. The robust forecast is related to the sustained growth of technical workstations, local-area networks, minicomputers and high-performance microcomputers that use the 80386 microprocessor.

"The name of the game for disk drive manufacturers now is to get designed into systems this year," says James Porter, Disk/Trend president. "Not getting in this year could mean not getting business later."

As would be expected, the early market leaders are the dominant players in the business. Maxtor claims to have at least five United States-based OEM customers, including Apollo. Micropolis also ships to Apollo, and to Compaq, Sun, Unisys and parts of AT&T. Maxtor introduced and shipped the first 380MB drive more than two years ago. It had

Worldwide shipments of hard disk drives



Sales of 380MB models are outstripping those of the hard disk drive market as a whole

pushed current technology to its limits in order to leave the competition behind, but since then about 14 disk drive vendors have jumped on the bandwagon.

One notable newcomer to the fray is Siemens Information Systems. It has the dubious distinction of being one of the first to break the 300MB barrier. However, at 310MB, the Siemens unit fell short of what the industry ultimately rallied behind.

Market solidarity

"The market has clearly solidified behind the 380MB approach," says Dennis Resnik, vice president of the Memory Products Division of Siemens Information Systems, Newbury Park, Calif. "Since we're late to market, our strategy is to emphasize performance," Resnik adds. The Siemens drive is enhanced to transfer data quicker than most other 380MB drives currently available.

Another relative newcomer is Toshiba America Inc., Irvine, Calif. "The 380 is what everyone was waiting for," agrees David Tovey, director for marketing for Toshiba's disk products division.

Taroon Kamdar, Maxtor director for marketing, says all major workstation vendors have or will soon announce 380MB-based high-end systems. "The power of 32-bit microprocessors is going to require high-performance disk drives and will propel demand," he notes.

The rapidity with which systems vendors have integrated the drives is primarily due to industry standards. Computer vendors have rallied around the 5.25-inch form factor and, more recently, the SCSI and ESDI interface which connects the drive to the computer system. The 380MB drive is also very similar in design to its 170MB predecessor.

James Stone, an analyst who follows the disk drive industry for Merrill Lynch Research & Economics in New York City, projects that three-fourths of all systems shipped with an 80386 microprocessor during the next year will include a 380MB disk drive as an option. The 380 costs about $500 more than the 170, but a user gets more than twice the memory capacity. The 170MB drive had a relatively short shelf life because most of its disk storage capacity was used up by the time software and other data-intensive requirements were loaded onto the system.

"The 380 is a good balance between system costs and storage needs," says Stone. The most successful disk drive companies grew 50% last year, will grow 40% this year and 30% a year thereafter, he adds. "That's extremely strong growth. Not too many technology areas are doing that."

The ease with which system engineers have been able to integrate the 380MB models into their systems caught the industry by suprise. As a result, drive makers are unable to meet a backlog of current orders. By the end of this year, the situation could change markedly, however.

Serious competition among disk drive vendors is expected by December, by which time the drive manufacturers are expected to be fully ramped up to meet most of the expected demand. For example, Micropolis should be building 35,000 drives per quarter this year, compared with 9,000 last January, says Dave Vellanti, director of storage research for International Data Corp. of Framingham, Mass., a market research company.

Three-fourths of all 386-based systems shipped in the next year will have 380MB drives as options

"Once customers see that orders can be met, some orders will evaporate. Supply will exceed demand and a lot of little companies could be hurt," projects Vellanti. "It's really a volume game and you've got to have some major customers in order to survive."

Key issues for drive makers in 1988 are in purchasing enough recording heads and disks. These products were previously in short supply, which caused several publicly held drive companies to rein in their quarterly projections. Adequate sourcing of these products could be critical to the 14 companies currently jockeying for market position.

A major supplier of thin-film recording heads, Read-Rite Corp., Milpitas, Calif., ran into serious difficulty last year. Because it reportedly ignored a key supplier that advised of certain changes to chemicals used to etch silicon in the development process, Read-Rite was unable to ship products. Read-Rite, now under new management, is returning to normal supply levels, and compared with a year ago, demand for its heads has more than doubled, up to 3 million.

Komag Inc. of Milpitas, Calif., a major supplier of thin-film disks used in the drives, expects to ship about 5 million disks this year, compared with less than 2 million last year. Most of the disks will be sold into the 380 market, says Hunt Payne, maketing vice president.

Three significant players

Three players could make a significant dent in the market, however. IBM, DEC and Hewlett-Packard have programs to build their own versions of the 380. However, DEC has yet to introduce any 380MB versions into its computer systems, and the word in the industry is that DEC is searching for 380 MB disk drives from outside sources. If so, it has the ability to absorb enough drives to potentially disrupt the activities of other systems vendors.

HP, which has received some disk drive orders from Prime Computer Inc. and AT&T, could challenge the industry in a different way. Aside from supplying its own internal needs for the big drives, HP is aggressively going after OEM deals. If successful, economies of scale in manufacturing could help it become a price/performance leader. The 380MB drive, when first introduced, cost about $3,000. Prices have since dropped to about $1,500 and are expected to soon drop further to $1,200 — especially now that buyers have begun planning for next-generation 760MB drives as well as for half-height 380s. □

Big systems integrators hit up their rivals for business

Systems integrators, like AT&T, IBM and other computer companies, are seeking potential customers in their peers

BY MARY JO FOLEY

To date, computer companies have been their own best customers for commercial systems integration (CSI). In other words, IBM has relied almost exclusively on its own systems-integration experts to design, automate, and link most of its in-house data-processing computer-integrated manufacturing, and other operation areas. AT&T, Computer Sciences Corp., Digital Equipment Corp. and the other top systems integrators have done the same.

But now that they have had a chance to hone their expertise, CSI vendors are ready to progress to designing, procuring, installing and maintaining systems for other firms, including other electronics and systems companies. If the CSI market is to grow from $1.5 billion in 1987, to $7.2 billion by 1992, as the Mountain View, Calif., market research firm Input predicts, these high-tech companies will need to be a big part of most CSI vendors' bread and butter.

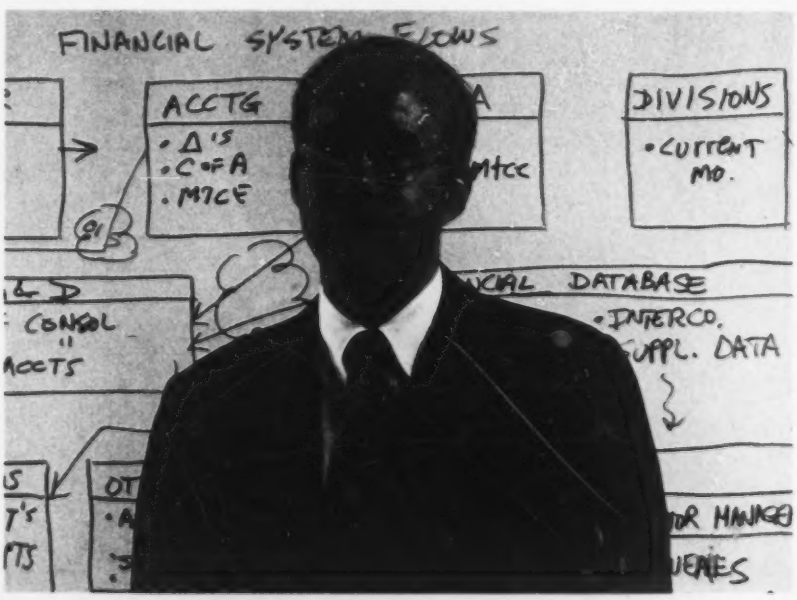
"Commercial users are finding they are over-hardwarized but under-computerized, just like the federal government," says Stephen McClellan, a securities vice president at Merrill, Lynch, Pierce, Fenner & Smith. "The biggest need is in the *Fortune* 1,000, and that's where the initial biggest demand will be."

Systems-integration vendors and customers in all industries are notoriously loathe to talk about their highly confidential integration projects. Nonetheless, word has gotten out about a few. For example, Computer Partners Inc., the Waltham, Mass., CSI subsidiary of Computer Sciences, is known to be enhancing and maintaining a complex circuit system for network systems planning for AT&T. Electronic Data Systems Corp., the celebrated systems-integration subsidiary of General Motors Corp., counts among its integration customers Korea's Lucky Goldstar Group.

IBM, for example, recently changed the name of its primary integration division from Federal Systems to Systems Integration in order to reflect the increasing importance of commercial sales to its overall integration business. According to Steve Carns, general manager of systems integration and professional services for IBM, last year Big Blue was part of 2,000 SI contracts, as either a prime- or subcontractor. Roughly 46% of the customers for IBM's SI services were among the top 50 of the *Fortune* 250, Carns says. In three-quarters of the bids it submitted for winning SI schemes, IBM bid non-IBM hardware alongside its own hardware, software and services, he adds. Carns predicts that the largest future SI contracts for IBM will be in the areas of health, telecommunications, computer-integrated manufacturing, in-house publishing and factory or office automation.

AT&T is another systems company gearing up to participate in CSI. In late March, the telecommunications giant formed a systems-integration division which will most likely focus on marketing the company's networking expertise.

Despite the name-brand recognition enjoyed by hardware vendors, professional service companies are as likely, if not more so, to win a sizable chunk of the CSI pie, industry watchers say. "No longer can a company



Suzanne Anderson

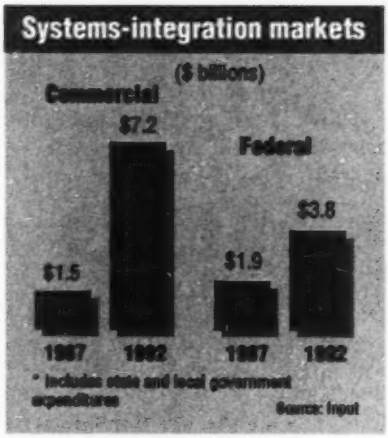
Contel's Kenneth Bottonari: "We felt EDS underperformed in terms of completeness and quality in the designated time frame"

be a service or a product company. Now one must be both," says Mel Bergstein, a partner in one such firm, Chicago-based Arthur Andersen & Company. "When clients want products, they call service companies first. The bottom line is you need to be a systems integrator."

Secret weapons

However, the extent to which CSI vendors will be able to capture the business of a substantial number of systems, software and service companies remains to be seen. In part, this uncertainty is due to the nature of the systems-integration business. Integration projects tend to be extremely complex. Many times, they are companies' "secret weapons," and as such, are key to their gaining and maintaining a competitive edge. Thus, a company which acts as another's systems integrator must be privy to a considerable amount of confidential technology and marketing data in order to do its job. In the case of computer and systems companies, the integrators with which they need to share this information are, or can be construed as being, their competitors.

In addition, as is true in the federal marketplace, CSI vendors often find themselves face to face with cost overruns, hard-to-meet deadlines, and other constraints. In government, customers routinely are expected to accommodate and absorb these setbacks; but in the commercial world, vendors pay for mistakes, both in dollars and negative future references.



Commercial systems integration business should grow twice as fast as the federal market

Electronics companies are no more likely to be immune from these drawbacks to systems integration than are banks, insurance companies or retail stores. Communications giant Contel Corp. is a case in point. By all outward appearances, Contel looked like a company ripe for systems integration. Two years ago, managers at the company's Atlanta corporate headquarters decided it needed a new billing information system. Contel put out a request for proposals and received bids from key systems companies, including Arthur Andersen, EDS, GTE Data Systems and IBM.

Contel opted to go with EDS, which began work on the project in September 1986. In December of the same year, Contel terminated the contract. "We felt EDS underperformed in terms of completeness and quality in the designated time frame," says Contel vice president for information management, Kenneth Bottonari. "The scope of the project was bigger than anyone originally understood." The project has gone into a reevaluation and replanning stage since. Currently, Contel is contemplating going the joint venture route to complete its billing system — an approach in which it engaged successfully on a similar financial and administrative reporting system in conjunction with Arthur Andersen, Bottonari says.

This isn't to imply that high-tech customers are impossible to please. The Montgomery-based Alabama Supercomputer Authority, for one, is more than satisfied with its CSI choice of Boeing Services Corp., according to director Ben Barnes.

The Authority, an advisory group charged with managing data systems for the state of Alabama's finance department, issued a request for proposals for a statewide supercomputer network in October 1986. In January 1987, the group unanimously decided to go with Boeing for the $39 million, five-and-a-half year contract.

"Even though they weren't the low-cost bidder of the six [which participated], they already had operated a supercomputer center in Seattle," explains Barnes. "They had a good overall understanding of supercomputers, and a high-quality staff." □

The golden rules of systems integration

William Hoover, chair and president of one of the most successful systems integrators — Computer Sciences Corp. of El Segundo, Calif. — offered an extended version of these remarks at a software and services management conference earlier this year.

What it takes to be a systems integrator:

• 1. Current and future integrators need to form strategic alliances to fill out their capabilities. No single company is likely to possess all of the resources and technology required to build the major information systems in the offing.

• 2. Not every company can be a prime contractor. This may be due to a company's own strategic direction, or because it simply lacks the management and technical structure to be a systems integrator.

• 3. To be a successful integrator, a company must have a culture that is oriented toward project management rather than toward professional services or a specific project. In order to build and maintain this cultural environment, you need:

a. Good project managers experienced in systems integration and a multidisciplined technical staff with proven expertise in hardware, communications, software, workstations and other relevant technologies.

b. Well enforced project management standards, methodologies and tools.

c. A structure for the evaluation of emerging technologies and existing products.

d. Solid support staff and functions, including experienced procurement staff; an established subcontractor management structure; material-management and project-accounting people; and a quality assurance team. □

European team effort breaks ground in software standards

Europe's $8 billion answer to Japan's Fifth-Generation Computer Project has yielded valuable new industrial- and office-automation standards

BY SIMON PARRY,

As the second phase of Esprit (European Programs of Research in Information Technology) gets ready to kick off, the European Commission, independent assessors and industry are studying hard the first four years of the programs.

And they mostly agree that Esprit 1 — the first phase of Europe's multinational, multibillion dollar answer to Japan's Fifth-Generation Computer Project — has largely been a success. Although the projects in the first phase have another year to run, the general prognosis is that Esprit 1 has challenged its three broad goals.

They were: to make the European information-technology (IT) industry more competitive; to engender cross-border collaboration within the community; and to develop internationally recognized standards.

The European Commission believes this success signals the revival of Europe's IT industry and hoists the warning flags to its U.S. and Japanese competitors. Five years ago, when the talking on Esprit started, Europe was in danger of being crushed. But now, the commission believes, the IT industry in Europe is healthy and has a significant and powerful role to play in the world's IT industry.

But while the commission's secretariat is understandably bullish about the success of Esprit 1, some independent assessors are more cautious. Paul Hare, an economist at Heriot-Watt University in Scotland, who is carrying out an independent assessment for the British government's Department of Trade and Industry, is one: "The great majority of responses I have had have been positive, but it's difficult to measure the concrete outcome of the projects. Collaboration is not very valuable unless products go on the market at the end of the day," he says.

Commercialization is indeed the predominant thrust of the soon-to-begin Esprit 2 phase.

Esprit's achievements come at a crucial time. Plans are well advanced for the single European market to be established in 1992. Europe will then become the world's third major homogeneous market. Market researcher Dataquest Inc. estimates that Europe's computer systems market was worth $35 billion in 1987, compared with $50 billion for the United States. By 1991, Europe will account for $50 billion and the United States, $65 billion.

Furthermore, if collaboration between European partners continues from the research laboratories out into the market, U.S. and Japanese competitors will face serious challenges. And with U.S. and Japanese computer firms adopting Esprit-developed standards, the Europeans could well have a large influence in North America and Japan.

Esprit 1 had a total budget of $3.88 billion (all figures calculated at an exchange rate of $1 = .54 pounds sterling) split 50-50 by the European commission and the participating companies. According to Esprit's annual report at the end of 1987, out of a total of 227 projects, 143 had produced results of "industrial significance," 27 had resulted in marketable products, 44 had products under development and 28 had contributed to an international standard. About 5% of the projects had been stopped or merged.

Results from Esprit, Phase 1

Out of 227 contracts for 204 separate projects...

... 143 produced results of "industrial significance."

Examples: Project 554, "Spectra," aimed at developing a submicron CMOS semiconductor process;

Project 820, Italian/French/German consortium producing an intelligent knowledge-based system for process control.

... 27 resulted in marketable products.

Example: Project 1085, the supercomputer built from arrays of Transputer processors, which is now being marketed by Thorn-EMI under the name "Parsys."

... 44 had products under development.

Example: Project 532, a software package for real-time generation and display of two and a half dimensional sketches for moving scenes.

... some contributed to an international standard.

Example: Project 8613, Office Document Architecture, which has been accepted by the International Standards Institute.

Source: European Commission

Useful spin-off

There have been some solid examples of useful spin-off from Esprit. A senior Esprit official who declined identification says a "key intention" has been to develop software standards. This would act as a supporting movement for the onset of the single European market; everybody would know how to build computers that could be sold throughout the community.

The Communications Network for Manufactur-

ing Applications (CNMA) is a good example; it is already starting to change the way in which European factories run. CNMA is Europe's contribution to Manufacturing Automation Protocol (MAP), the factory communications standard developed by General Motors Corp., but it is more wide ranging. The project was led by British Aerospace Plc and involves a consortium of 13 users, vendors and systems organizations from four countries including Germany's BMW AG, France's Peugeot Groupe SA and Italy's Alitalia Plc.

Work started in 1986, and last year the consortium was able to demonstrate the interworking of robots and other production equipment from a number of manufacturers. Now there is a fully installed and working production line in BMW's car plant in Rogensburg, West Germany. The automatic line helps build BMW's top-of-the-line 3 and 5 series models.

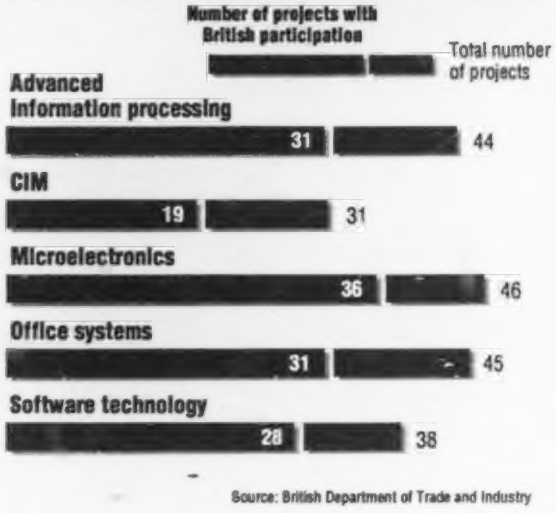
This was the world's first factory implementation of the Manufacturing Message Service, a major element of MAP version 3.0.

A second CNMA production line is being established at a British Aerospace plant to build wings for the Airbus passenger jet. Later this year Alitalia will also install a CNMA production line which will be linked to the British Aerospace line via a wide area network.

Similarly, the Office Document Architecture (ODA) is a formatting standard whereby files can be passed from one desktop computer to another. The main participants in this project are computer makers Ing. C. Olivetti and Co., Siemens AG, Groupe Bull and ICL.

The ODA was accepted last year by the International Standards Institute, of which IBM is a member. Siemens is leading a second project to extend the architecture to text, image and voice documents. "Clearly," says the Esprit official, "this program is just not about manufacturing products. We needed to produce the technology which could then be pulled through to products."

Britain is one of Esprit's strongest players



Source: British Department of Trade and Industry

As an example, he cites Project 1085, which involved successful assembly of a supercomputer from arrays of Inmos Plc Transputer processors with a performance comparable to that of a Cray supercomputer, but at a fraction of the cost. The supercomputers, called Parsys machines, will be sold by the British firm Thorn-EMI and by French firm Telmat.

But now Esprit executives have their time well filled with setting up the second phase. Esprit 2 has a slightly larger budget of $4.14 billion; the commission has received over 700 proposals.

U.S. and Japanese firms have been able to participate in Esprit

The proposals will be sorted until the commission has given its approval to about 150 projects. The commission is rushing through the work so that research contracts can be awarded during the summer.

The Esprit mandarin hopes that an increased budget would attract "more important projects" which would be allowed increased individual budgets up to $37 million. "It came out quite clearly in our first interim review," he says, "that we had to have deeper research and bigger projects."

U.S. participation

Interestingly, U.S. and Japanese firms have been able to participate in Esprit projects. Indeed, the commission has not shied from using scare talk of U.S. and Japanese threats to bludgeon both governments and companies into investing in the program, but yet has not excluded non-Europeans from having a useful input. This U.S. involvement has not been without its humorous side: there was an early glitch in a CIM project, in which it apparently had not occurred to management at Digital Equipment Corp.'s Clonmel, Ireland, plant that its Italian collaborators would not speak English.

Some U.S. participants believe they have a critical role to play in making Esprit work. "In the case of Esprit, if it has been to the benefit of the European community to bring in U.S. companies, it's done," says Wilfred J. Corrigan, chairman of ASIC chip maker LSI Logic Corp. Corrigan and others are less open when non-U.S. participation in pro-U.S. electronics industry projects like Sematech are discussed.

Economist and Esprit-watcher Paul Hare wants Esprit 2 to concentrate on commercial exploitation of technologies, in line, he said, with the framework for the phase set out by the commission. "I would want Esprit 2 to be the magnet that pulls the good products out," he explains.

Hare also believes there will be a marked difference in the size of companies that participate in Esprit projects. Small companies had been particularly successful in Esprit 1 and deserve a lot of the credit for commercial exploitation.

"Two-thirds of the Esprit 1 projects involved small companies and they would have been unable to participate without clear products in mind. They could not afford the resources otherwise," he says. However, the commission has a declared goal of bigger projects for Esprit 2, which would tend to preclude small company involvement. □

CD-ROMs: Prices fall and shipments begin to spin

More applications and even lower price tags are needed, but manufacturers and customers are finally interested

BY BRIAN DEAGON

A few months ago, a Hewlett-Packard Co. spokesman announced to a group of customers that the 65 manuals needed to support its minicomputer would soon be available on one 4.7-inch CD-ROM. The crowd of users interrupted the speaker with applause. Some even stood and hollered encouragement.

"Our customers went wild," says Doug Chapin, HP product marketing manager in Mountain View, Calif. "It's been a major challenge for them to access documents needed to support our HP3000 minicomputer."

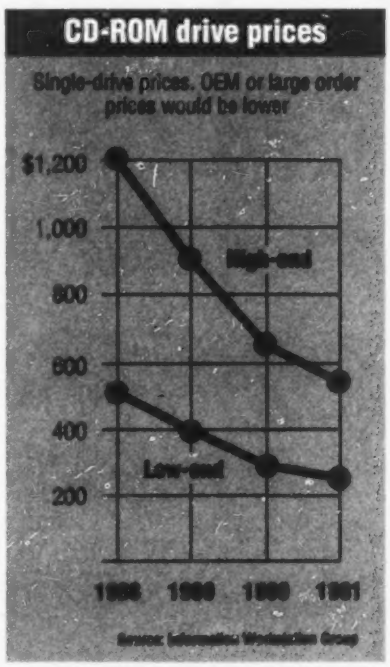
The technology is worth whooping about. Few peripheral computer products introduced during the past five years have offered so much for so little. One small shiny compact disc, read-only memory stores more than 600 megabytes of data, equal to 1,500 floppy diskettes, 250,000 pages of text or a stack of documents 25 feet high. It can also hold 5,000 images or 16 hours of sound. The discs are rugged, easily transportable and unharmed by normal temperature fluctuations or magnetic fields.

Lately, the hoopla surrounding CD-ROM is coming from potential users and not from the manufacturers themselves. The promoters of CD-ROM technology are breathing sighs of relief. They were charged with being overly infatuated with the technology and less concerned about developing useful applications. As a result, millions of dollars were wasted promoting CD-ROM to an uninformed end-user community. CD-ROM stumbled through its first two years of marketing.

"The technology was more hype than hope," says Robert Katzive, vice president of Disk/Trend Inc., a Mountain View, Calif., research and consulting organization. "The real problem was that CD-ROM was a publishing medium and the publishers didn't have their wares in the market."

But that is changing. CD-ROM has the potential to radically change the way information is cataloged and delivered, in the same manner that its audio disc cousin changed the record industry. Since the genesis of CD-ROM in the early 1980s by N.V. Philips of the Netherlands and Sony Corp. of Japan, businesses have sprung up in support. About 15 manufacturers now sell the drives, at least 30 companies prepare data to put on discs, and more than 40 software houses write for CD-ROM applications.

According to a report by Freeman Associates Inc., a market research firm based in Santa Barbara, Calif., the value of CD-ROM shipments will rise to about $143 million in 1991, from about $69 million this year.



Stamp of approval

Several influential computer companies are poised to capitalize on CD-ROM. Developers of CD-ROM technology include Hitachi America Inc., Laser Magnetic Storage Inc., of Colorado Springs, Philips, Sony and 3M Co. Aggressive promoters and suppliers also include Amdek Corp., Apple Computer Inc., Digital Equipment Corp., Lotus Development Corp., Microsoft Corp. and Wang Laboratories Inc. The notable holdout is IBM, which has expressed considerable interest in optical technology. IBM showed a CD-ROM prototype, albeit someone else's drive, at a technical trade show in April. It sells a write-once, read many times (WORM) drive through regular channels, notes Dave Liddell, IBM manager for marketing programs for image applications development.

"The advantages to CD-ROM are so unique and valuable that it's inevitable this technology will be used broadly," insists Carl Stork, Microsoft director of CD-ROM marketing.

The industry's hope for a new beginning rests largely on the acceptance of mainstream business, which is starting to happen. For example, HP developed a parts catalog for Ford Motor Co. Lotus compiles a weekly financial database on discs. And London-based British Airways is testing a CD-ROM application that contains the entire parts catalog of a Boeing 757, about 12,000 pages of text and 6,000 full page drawings, onto one disc.

"That's 140 pounds of raw paper delivered on one disc," notes Chris Bowman, director for marketing and sales at KnowledgeSet Corp., a devel-

oper of CD-ROM softw[illegible]ased in Monterey, Calif. Customer interest has "increased enormously" during the past six months, says Bowman. Most customers are still developing prototypes because the cost of full-blown production is still too high for many, Bowman notes.

Another company evaluating CD-ROM is International Property Control Systems, a Phoenix, Arizona-based value-added reseller (VAR) of IBM systems. The company, which includes a chain of 450 restaurants and hotels among its customers, has put 33 floppy diskettes, 8 hours of recorded tape and 10 binders of data onto one CD-ROM disc. It will be used as an interactive training device.

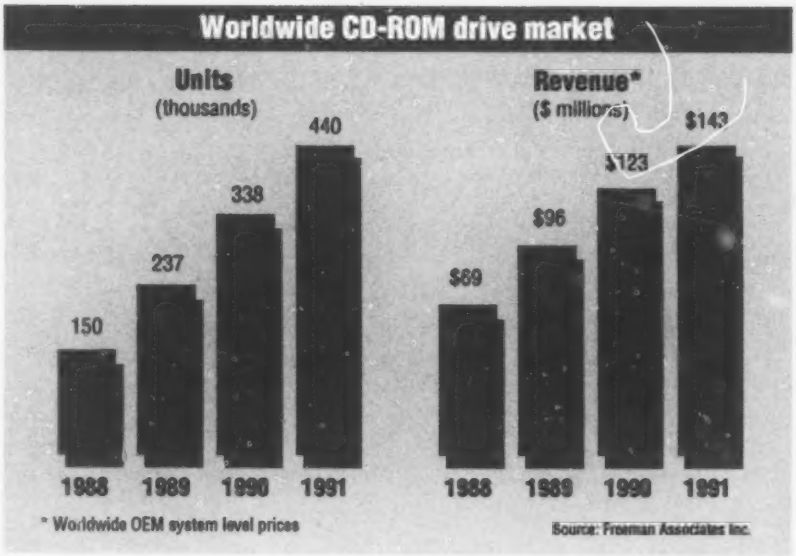
"I'm thrilled with the technology. The capabilities are phenomenal," agrees Carolyn Keith, IPCS training development manager. But a current roadblock is that the drives are "awfully expensive," she adds. It is a comment frequently echoed.

Market obstacles

Obstacles to the large-scale acceptance of CD-ROM are the high cost of entering the market and the dearth of CD-ROM applications. These barriers are slowly being chipped away through the efforts of the High Sierra Group, a consortium of industry players who agreed on how data would be placed onto the discs, in a manner that would be consistent from one drive to the next. Microsoft also developed a software operating system that allows an entire CD-ROM disc to be read as though it were one massive floppy or hard disk drive running under MS/DOS.

Meridian Data Inc., Capitola, Calif., chipped in by developing software that reduces the time and cost of designing and mastering a CD-ROM disc for mass distribution. It typically costs about $4,000 to make one master, but several masters are usually needed to get the bugs out of one application, easily driving costs above $20,000. Once mastered, duplicate discs can be made for about $4 each.

"CD-ROM has been overhyped but it's also on a steady growth path. It's beginning to catch up to the hype," says John Gale, president of Information Workstation Group, Alexandria, Va., a consulting and market research group for optical technologies. "All the basic standards are now in place."



The result of this activity is that software developers have an easier time creating CD-ROM disc applications, while original equipment manufacturers, system integrators and VARs have an easier time implementing the technology. Currently, not enough application discs — sometimes called titles — are available to generate large-scale demand for the drives. Industry watchers agree that upward of 1,000 mastered discs with broad consumer appeal are needed. More than 2,000 master audio discs were available before consumers invested in CD audio players in a big way, notes Scott McReady, an analyst with CAP International, a market research organization in Marshfield, Mass.

Meridian Data developed software that reduces the time and cost of designing a CD-ROM disc

Somewhere between 100 and 200 general titles currently exist, aimed primarily at legal, medical, financial, library and scientific markets. CD-ROM discs are frequently used as directories, catalogs and parts lists. Many more discs are developed for internal applications for a company. In total, about 700 CD-ROM disc titles have been mastered.

"There are not enough CD-ROM titles to support a rapid growth," says McReady. "We've still 18 to 24 months to go before enough published titles are available for the market to take off," he estimates.

Nonetheless, market interest continues to grow. At the third CD-ROM international conference sponsored by Microsoft in March, about 2,000 people attended, compared with 1,300 a year ago. Apple used the show to introduce its first CD-ROM product for the Macintosh and Apple II computers, priced at $1,199. Nine additional companies announced they would support the Apple drive with various products.

Microsoft has published three titles aimed squarely at the consumer market. And perhaps as a precursor of things to come, McGraw-Hill Book Co. has published a paperback described as a comprehensive primer for the next wave of CD-ROM technology. New versions of CD-ROM will have multimedia capabilities, combining audio, digital, still graphics, sound and moving pictures. The book was authored by technical staffers at Philips.

"There is nothing to drive this industry to dizzying highs overnight," notes Disk/Trend's Katzive. "But those companies that hang on now and pay their dues will be repaid downstream." □

Can analog design software revitalize communications?

Yes, by providing product differentiation. But that doesn't make life any easier for U.S. equipment makers

For the past four quarters, growth in the Federal Reserve Board's index of industrial production of communication equipment has slowed down to a crawl. But this should not be discouraging, reminds Cahners' senior economist Elizabeth Baatz, because the FRB index consists mostly of military communications equipment. This segment has gone on a diet with the freeze of new defense programs, and is unlikely to get refired.

The commercial components of the index may be doing a little better. AT&T's revenue increased by 3% in the first half of 1988, but most of this growth is coming from services such as long distance, rather than from sales of equipment. Northern Telecom Inc. did a little better at 5%. Only half of its production, however, is in the United States, and thus counted in the FRB index. The other half is in Canada, Northern Telecom's home base. And, increasingly, the company is contracting for subassemblies made in Korea by Daewoo.

What could bring growth back to the U.S. communication equipment manufacturers is the increasing availability of productivity-enhancing software tools for analog IC design. Analog and mixed-signal (analog plus digital) ICs are at the heart of every new piece of communications equipment, from PC-grade modems to PBXs to the telephone utilities' central office equipment. But, even though SPICE (simulation program with IC emphasis), the classical computer program used to model the behavior of analog chips, is one of the oldest CAD programs, designers of analog ICs lack the range of low-cost software tools available to their digital colleagues.

Analog Devices Inc., the leading manufacturer of analog chips, is now investing "significantly" in both homegrown and commercial tools, says chairman and president Ray Stata. At the same time, the company's five-year plan calls for "dedicating increasing resources to address the communications markets, especially at the high end of the modem business," he adds. Rockwell International Corp., which dominates the market for modem chips, uses its own software for complex designs on Digital Equipment Corp. VAX computers and commercial software to enter the design parameters on PCs.

Martin Walker, vice president of software vendor Analog Design Tools Inc., admits that the analog gurus who design ADI's chips prefer to build their own tools. But he believes that, by involving designers who have not developed their own analog design software, mixed-signal chips will increase the demand for commercial tools made by companies such as his. Examples are logic designers who must craft the analog portion of their chips, and test engineers who must interface the new chips with their testers.

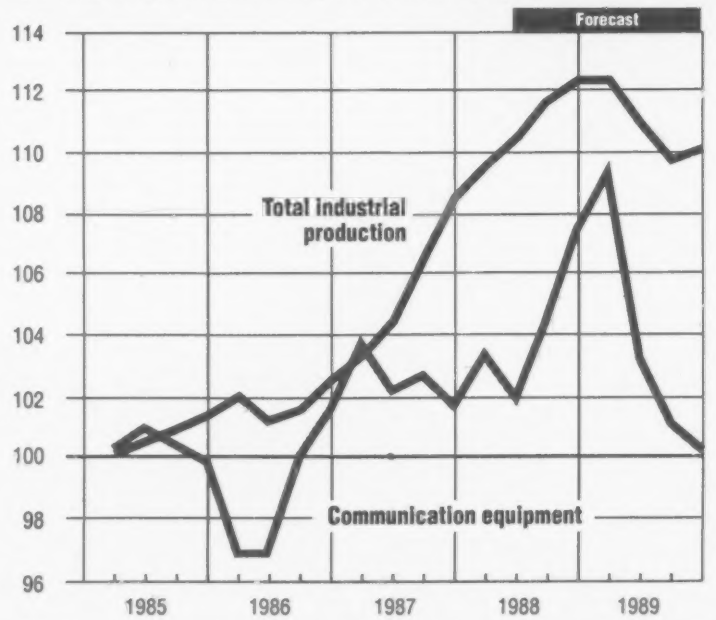
As the name of the company implies, the strength of LSI Logic Corp.'s engineers is in digital design. Yet, like ADI, this leading maker of ASICs is also developing its own software to design its future generation of mixed-signal ASICs. The reason, says marketing vice president Robert N. Blair, is that the design software must be tightly coupled with LSI Logic's design environment. "This is far more critical with analog than with digital circuits," he explains.

Where both Blair and Walker agree is in the promise of mixed-signal chips for equipment manufacturers. "Product design starts with the IC," says Blair. "The name of the game is differentiation in cost, features and/or size." While mixed-signal chips shrink product cost and size, he adds, "analog gives you differentiation." Walker, however, comments wryly that NEC Corp., a leading Japanese manufacturer of communications equipment, already uses his company's tools to design differentiated products.

ALBERTO SOCOLOVSKY

Communication equipment production index

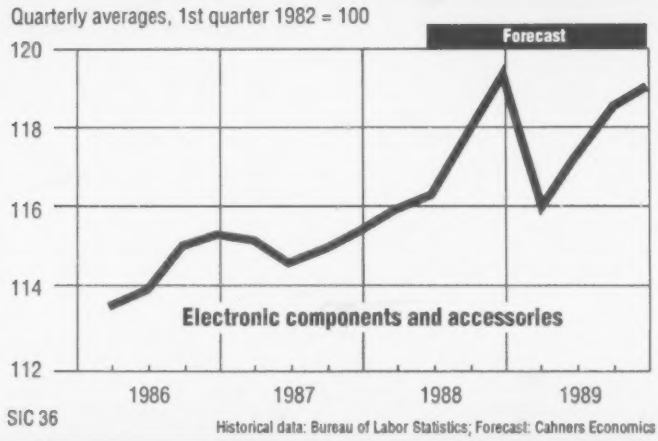
Quarterly averages, 1st quarter 1985 = 100, seasonally adjusted



SIC 366

Historical data: Federal Reserve Board; Forecast: Cahners Economics

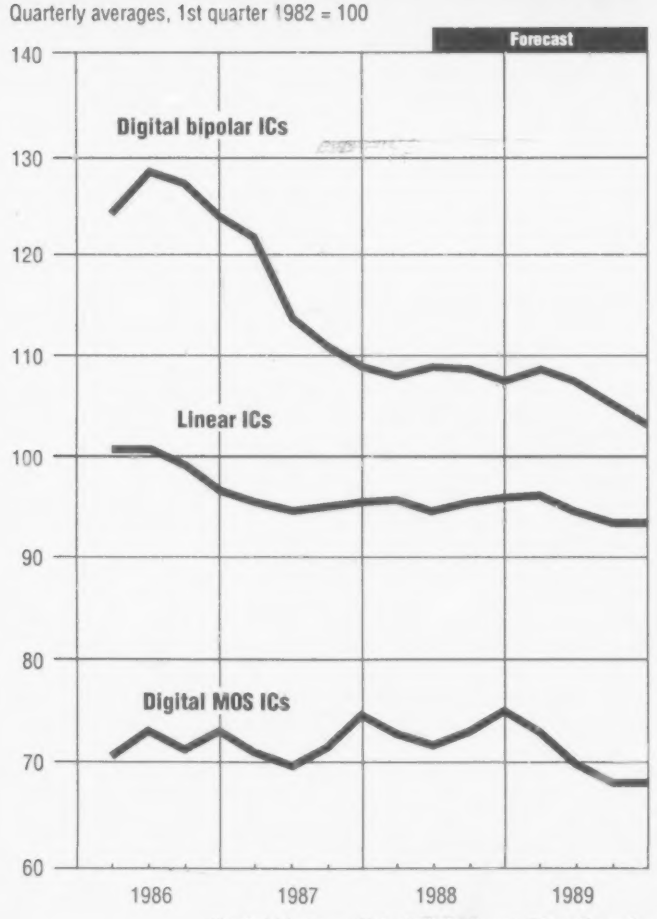
Producer price index — Electronic components



SIC 36

Historical data: Bureau of Labor Statistics; Forecast: Cahners Economics

Producer price indexes — Active components



Historical data: Bureau of Labor Statistics; Forecast: Cahners Economics

IC prices will rise slowly through early 1989

After three years of annual price declines, linear IC prices rose 0.3% in the first quarter of 1988 from a year ago. Prices are expected to continue rising through the first quarter of 1989, but this rise will be very slow. All told, the linear IC price increase will be only 0.3% in 1988, followed by a 1.2% decline in 1989.

Digital MOS ICs, which haven't seen a price increase in the past three years, are also seeing higher prices. In the first quarter, prices showed a 2.8% inflationary gain, compared with a year ago. These prices appear headed for similar increases in the next few months. By the end of 1988, annual producer prices for digital MOS are expected to rise 2.3%. But this increase will be short lived, as another 4.4% price decline is likely in 1989.

Digital bipolar ICs continued to show a severe deflationary trend. The producer price index stood at 108.4 in the first quarter of 1988, which is 11% below the price index of a year earlier. In 1988, price levels are expected to remain relatively stable. Because of higher prices in the first quarter of 1987, bipolar IC producer prices will register about a 4.8% price decline in 1988.

Understanding producer prices

What does all this producer price data mean? First, remember that producer price indexes from the U.S. Labor Department simply measure average changes in prices received by domestic producers. They are obtained by confidential surveys of a sample of the industry. Also, they are designed to measure changes only in domestic output, so imports are not covered.

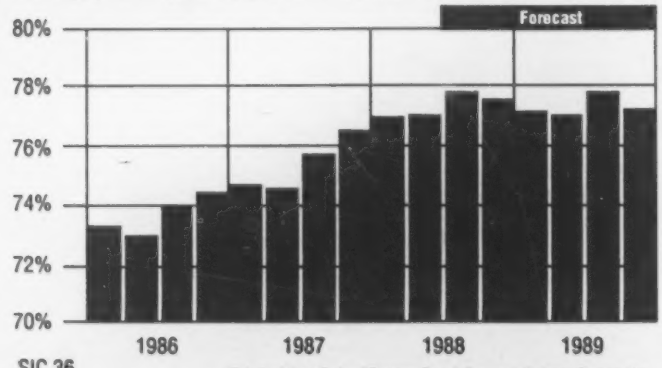
Producer prices are expressed as index values in order to disguise the actual dollar value of a price. In this way, the Labor Department does not reveal any specific company price data and insures confidentiality. The best way to look at any price index is to calculate the annual percentage change in the index. This gives some relative measure of an inflation rate for a product.

If the percentage change in a price index is rising quickly, then we have some idea of the inflationary prospects for a particular product's price. In the case of electronic components, despite the DRAM price panic, most other component product prices are rising only slowly, which bodes well for electronic industry product prices holding steady as well.

ELIZABETH BAATZ

Plant utilization — Electrical machinery

Average percentage of capacity utilized per quarter, seasonally adjusted

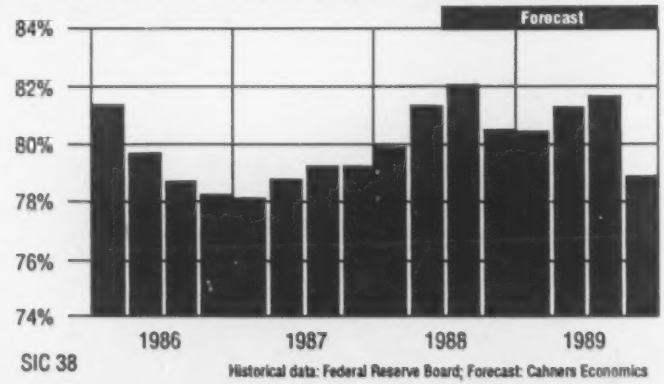


SIC 36

Historical data: Federal Reserve Board; Forecast: Cahners Economics

Plant utilization — Instruments

Average percentage of capacity utilized per quarter, seasonally adjusted

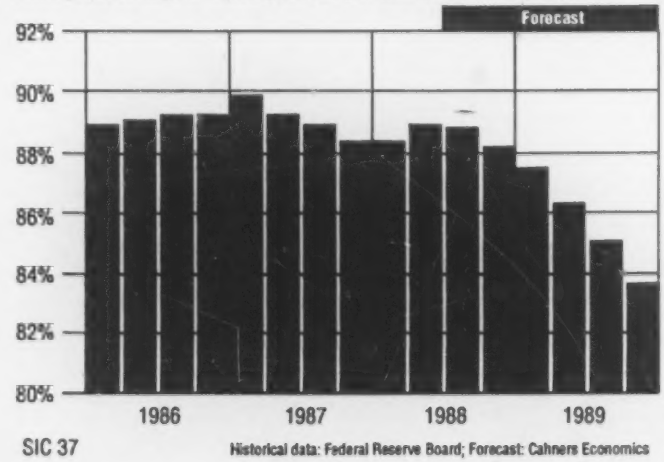


SIC 38

Historical data: Federal Reserve Board; Forecast: Cahners Economics

Plant utilization — Aerospace

Average percentage of capacity utilized per quarter, seasonally adjusted



SIC 37

Historical data: Federal Reserve Board; Forecast: Cahners Economics

Capacity utilization rates are still on the rise

Operating rates in the manufacturing sector averaged 83.1% in May, marking the third straight month of increases. Manufacturing capacity utilization has been above its 1984 peak value of 81.3% since October of last year and more increases are expected.

Tight capacity constraints are squeezing output in several of the process industries, particularly in the materials sector. Utilization rates for paper are at 100%; aluminum hovers at 97%; chemicals and raw steel are at around 90%, and the energy materials sector utilizes about 85% of capacity.

The durable goods sector has a little more breathing room. At an operating rate of 81.6% in May, durable goods utilization continued to climb from its most recent low of 75.1%, back in June 1986.

Overall, electronics is in good shape

Constrained capacity is not a factor choking off the expansion in the electronics and electrical machinery industry. True, the operating rate for this industry is about 5.6 points above its most recent low of 72%, but it is safely below the 82.3% mark hit back in 1984. Our forecasts keep the rate below 78% throughout next year.

Plant capacity utilization rates for electronic manufacturers, based on *Electronics Purchasing* magazine's monthly survey, indicate the electronics portion is operating under tighter capacity conditions than average. The utilization rate climbed to 84% in June, tying its old record of four years ago. That is the highest rate the survey has ever recorded since its beginning in 1983.

The story for the instruments industry is much the same as the electrical machinery industry. The May utilization rate of 80.3% is 2.6 points over the last cyclical low, but not yet close to the 85.7% peak of four years ago. The industry will have enough capacity to allow for continued production growth through next year without operating rates rising above the 82% mark.

Capacity utilization rates for the aerospace and miscellaneous transportation industry are relatively high, but on a slow descent. From a peak of 90% in March 1987, the operating rate subsided to 86.3% in May of this year. With real defense dollars shrinking, operating rates in the aerospace industry will continue to recede along with the cutback in production. Even so, utilization rates will tease the 83% mark by the end of 1989. That is well above the industry's 21-year average of 77.7%.

ELIZABETH BAATZ

Computers, office machinery rebound

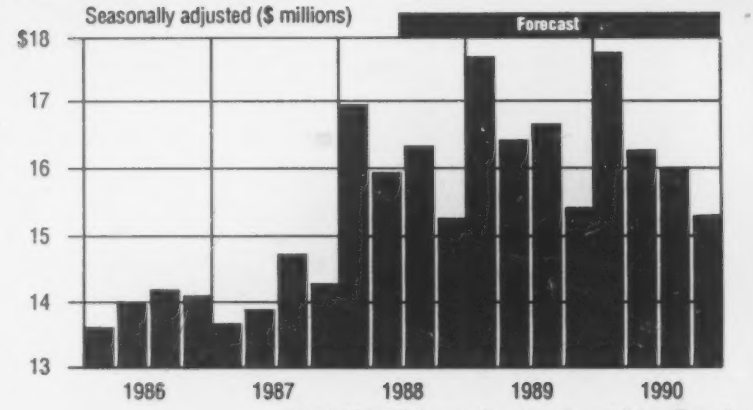
April new orders and shipments for computers and office machinery cooled from the fast pace of the first three months of this year. New orders dropped about 0.5% from March to April, while shipments sunk 8.8% over the month. Recall though, that the heated first quarter activity was a rebound from the sharp, but short curtailment after the stock market crash. So, these one-month setbacks are most likely not precursors to a downward trend at this point.

The $5.3 billion in new orders was still 8% above the same month last year and shipments of $5.19 billion stood 11% greater than last April. The inventory-to-shipments ratio did shoot up to 1.95 in April, up from 1.78 in March because of the tapering off in shipments; but, historically, the I/S ratio for this industry has been in the 2.0 to 3.0 range, so the latest figure is still below the critical mark.

Figures confirm that businesses continue to pour dollars into new computer equipment. Purchases of information processing and related equipment totaled $159.67 billion in the first quarter of this year at an annualized rate (constant 1982 dollars, seasonally adjusted). Of that, almost two-thirds went for computers and office machinery.

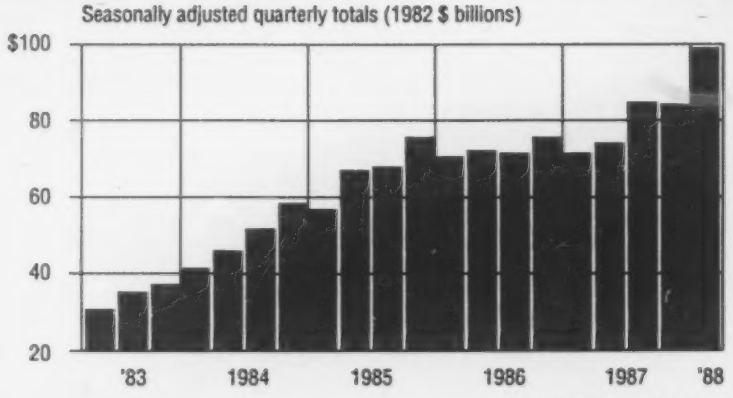
More information can be obtained from Madeline Franchi, senior economist, Cahners Economics Department, 275 Washington St., Newton, Mass. 02158. Phone: (617) 964-3030.

Computers and office machinery — Shipments



Historical data: U.S. Commerce Department; Forecast: Cahners Economics

Private purchases of computers and office equipment



Source: U.S. Commerce Department

Computer market database

	Latest month	Previous month	Change	Year ago	Change	Next year	Change
Industrial production (SA,1977=100, April)	308.6	304.9	+1.21%	284.5	+8.47%	322.5	+4.50%
Shipments (SA, $ millions, April)	$5,191	$5,695	-8.85%	$4,663	+11.32%	$5,479	+5.55%
New orders (SA, $ millions, April)	$5,309	$5,340	-0.58%	$4,913	+8.06%	$5,806	+9.37%
Unfilled orders (SA, $ millions, April)	$18,658	$18,540	+0.64%	$19,013	-1.87%	$20,200	+8.26%
Inventory-to-shipment ratio (SA, April)	1.95	1.78	—	2.06	—	1.97	—
All employees (thousands, April)	503.9	502.1	+0.36%	478.5	+5.31%	489	-2.92%
Production workers (thousands, April)	168.4	168.5	-0.06%	158.5	+6.25%	155.0	-7.97%
Exports ($ millions, March)	$2,175	$1,733	+25.5%	$1,685	+29.07%	$1,835	-15.64%
Imports ($ millions, March)	$2,051	$1,849	+10.91%	$1,557	+31.72%	$1,800	-12.27%

SA = seasonally adjusted, all other data is not seasonally adjusted

Data sources: Federal Reserve Board, U.S. Bureau of the Census and U.S. Bureau of Labor Statistics
All data for SIC 357, except industrial production, SIC 357-9. Forecasts: Cahners Economics